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Treatment of ununited and malunited fractures

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The treatment of jaw fractures requires great knowledge and experience. Failures result from various causes, and in many instances can be avoided. Poor results not only alter the appearance of the patient, but also affect the occlusion, the mobility of the temporomandibular joint, and the function of the motor and sensory nerves.

■ *Malunited Fractures*

Malunion is caused by a number of conditions and sometimes a combination of them. These conditions are as follows:

1. Delay in treatment. Serious complications often make it necessary to postpone the treatment of fractures of the jaws. In such instances fractures may heal in malposition; revision then becomes a special problem that can only be solved by surgical measures.

2. Inadequate roentgenographic examination. Obvious fractures are easily recognized but secondary fractures may be overlooked unless good roentgenograms taken from various angles are available.

3. Inexperience of the surgeon. Incompetent handling of fractures is another common cause of malunion. Anyone accepting fracture patients for treatment should be familiar with the various methods of open and closed reduction and the different procedures of fixation. Even a well-reduced, wired fracture may become displaced if the fixation is poor, particularly while the jaw is manipulated postoperatively to apply intermaxillary wiring, when the patient retches after anesthesia, when trismus develops, or even when the patient is swallowing or sleeping on the side of the head on which the fracture is located.

In condylar fractures the displaced, and especially the dislocated, condyle frequently is allowed to unite in malposition simply because open reduction and internal fixation is a tedious and difficult procedure. The condyle attaches itself in most instances, even if it is grossly displaced.

4. Infection of fracture. Loss of bone in infected fractures is the most common cause of malunion. The poste-

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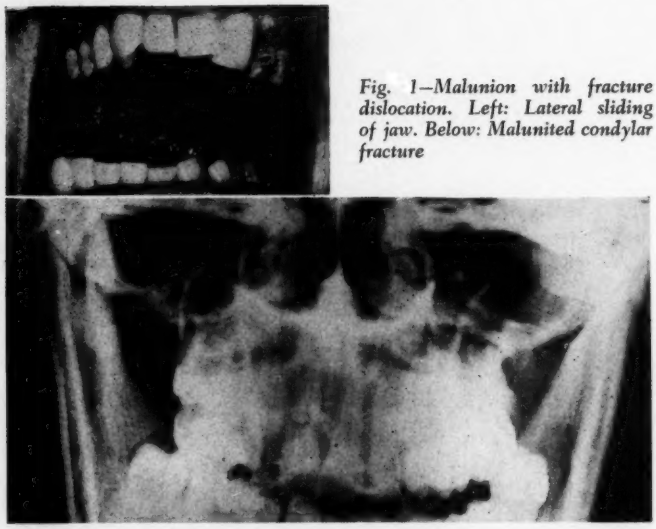

Fig. 1—Malunion with fracture dislocation. Left: Lateral sliding of jaw. Below: Malunited condylar fracture

rior fragment in such instances will be elevated by muscle pull.

CLINICAL OBSERVATIONS—Malunion often is accompanied by permanent functional disturbances which affect the mobility of the jaw, the occlusion of the teeth, the neurility and the appearance of the patient. It occurs most frequently in the region of the angle where the fragments overlap. If there has been a great amount of bone lost because of infection or osteomyelitis, however, then the posterior fragment may move superiorly until contact is made with the anterior fragment fixed in position by intermaxillary wiring (Fig. 10, above left). This will cause a poor cosmetic result and often prevents nerve repair with the result that there is permanent numbness of the lip. In edentulous jaws with bilateral fractures the malunion not only prevents the repair of the nerve, but if the mandibular canal is so out of line that it is not opposed by bone, an amputation neuroma may form under the gingiva, causing pain when the patient wears a denture.

Condylar malunion may be associated with pain during mastication and malocclusion. Today many patients are seen with traumatic arthritis caused or aggravated by occlusal abnormalities. It is not surprising, therefore, that patients with poorly reduced condylar fractures experience limitation of motion (Fig. 1) and pain in the temporomandibular joint, whereas others develop open bite or crossbite (Fig. 2, above left). In 1945 I described several cases of malunited fractures with functional disturbances[1] and since then have seen additional ones.

Although in the child the temporo-

1. Thoma, K. H. Functional disturbances following fracture of the mandibular condyle and their treatment. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 31:575 Oct. 1945.

mandibular joint may be completely rebuilt, in the adult such favorable results cannot be expected. The reason many patients whose condyles have healed in malposition have no symptoms is that in most instances angulation has caused shortening, and therefore the condyle is further away from its articulating surface and unable to cause trauma as long as the occlusion of the posterior teeth is adequate. If the occlusion becomes deficient, however, then symptoms appear—crossbite in unilateral fractures and open bite in bilateral fractures. Scar contraction usually causes this complication.

TREATMENT OF MALUNION—In the past a great many patients who were edentulous or had poor teeth and who had malunited fractures were aided by the use of artificial dentures. Although this procedure no doubt has given good results in certain instances, it certainly is not the answer when the complications are caused by the altered position of the temporomandibular joint, or when the facial appearance has been impaired. Facial asymmetry, obtuse angulation of the jaw, retrusion of the mandible and paresthesia cannot be eliminated by denture construction.

The treatment of malunion, if it handicaps the patient sufficiently so that intervention is indicated, should be a surgical revision with internal wire fixation. If there is a deficiency so that it is not possible to restore the normal length of of the jaw, bone grafts also should be used.

The procedure consists of separating the fragments and repositioning them. In most instances, if the fracture is not of

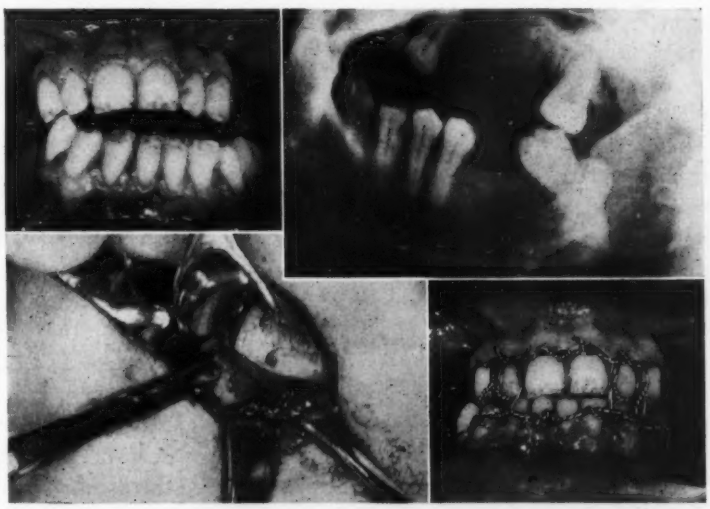

Fig. 2—Malunited angular fracture. Above left: Open bite. Above right: Overlapping of fragments. Below left: Use of two osteotomes to separate fragments. Below right: Occlusal result after revision and plating of fracture

too long standing, the fragments are attached to each other by fibrous union of one cortex against the other at the place where the fragments overlap. Such union can easily be severed by means of sharp, thin-bladed but broad osteotomes. Two such instruments inserted from different angles (Fig. 2, below left) will accomplish the division, but care should be taken not to use leverage since this might cause a fracture of the bone margin. If the length of the jaw is adequate when the fragments are properly positioned, all that is necessary is to freshen the ends and wire them together. In many instances, however, there is a deficiency in the length of the jaw. If it is slight, a bone plate may be applied, and the space may be filled with bone chips. If the deficiency is large, a rib graft may give a better result.

REPORT OF CASES—The following cases of malunited fractures are reported for illustration.

Malunited Angular Fracture with Malocclusion—A 30 year old woman had sustained a mandibular fracture seven months previously. She had been treated by means of intermaxillary wiring for three weeks. At the time of the examination, she had an open bite anteriorly and on the left side (Fig. 2, above left). The roentgenogram showed a healed double mandibular fracture with overriding of the fragments at the left angle of the mandible (Fig. 2, above right).

The fracture site was exposed through a skin incision and the fragments were separated by the use of two osteotomes (Fig. 2, below left). After the ends of the fragments were freshened and bleeding was stimulated by drilling, a bone plate was applied to hold them in position. The teeth were occluded, and Risdon wiring was used for intermaxillary fixation. A good result was obtained in seven weeks (Fig. 2, below right).

Malunited Fracture with Malocclusion—A 34 year old soldier was so seriously injured in World War II that he did not receive treatment for his bilateral fractures of the mandible. He improved beyond expectations, however, although he remained totally blind. When he returned home, he had great difficulty in masticating food because he was unable to occlude his teeth normally (Fig. 3, above left). Roentgenographic examination revealed malunion on the left side with an unerupted bicuspid in the fracture site (Fig. 3, above right). After revision of the fracture from an extraoral approach and transosseous wiring of the fragments in their proper position, the occlusion became normal (Fig. 3, below left). The fracture was healed after seven weeks of intermaxillary fixation (Fig. 3, below right).

Malunited Fracture with Facial Deformity—A 39 year old World War II Navy veteran had sustained a bilateral fracture of the mandible which had healed leaving a deformity causing retrusion of the jaw. He applied for corrective surgery; however, before treatment was begun, he got into a fight and was brought into the accident ward in an unconscious condition, with his mandible again fractured bilaterally. Since he had the preexisting deformity of the jaw (Fig. 4,

above left), open reduction of the fractures with advancement of the anterior part of the jaw was recommended. The operation was performed by bilateral extraoral exposure of the fracture sites (Fig. 4, above right). The fragments were distracted and held in this position by means of a bone plate. Chip grafts were wedged between the fragments and placed around the metal plate (Fig. 4, below left). The patient's appearance was greatly improved (Fig. 4, below right).

MALUNITED CONDYLAR FRACTURES—Condylar fractures that are malunited may be handled in two ways; namely, by condylectomy or by reconstruction of the temporomandibular joint. Condylectomy, of course, does not result in anatomical restoration and normal functioning of the jaw; however, it gives relief of bothersome symptoms and often, particularly if a normal dentition is present, yields a satisfactory result. The patient must be taught to re-educate the muscles of the jaw so that they will be able to function without the aid of the temporomandibular joint. In most instances, active functional treatment should be instituted at once, and immobilization is contraindicated ex-

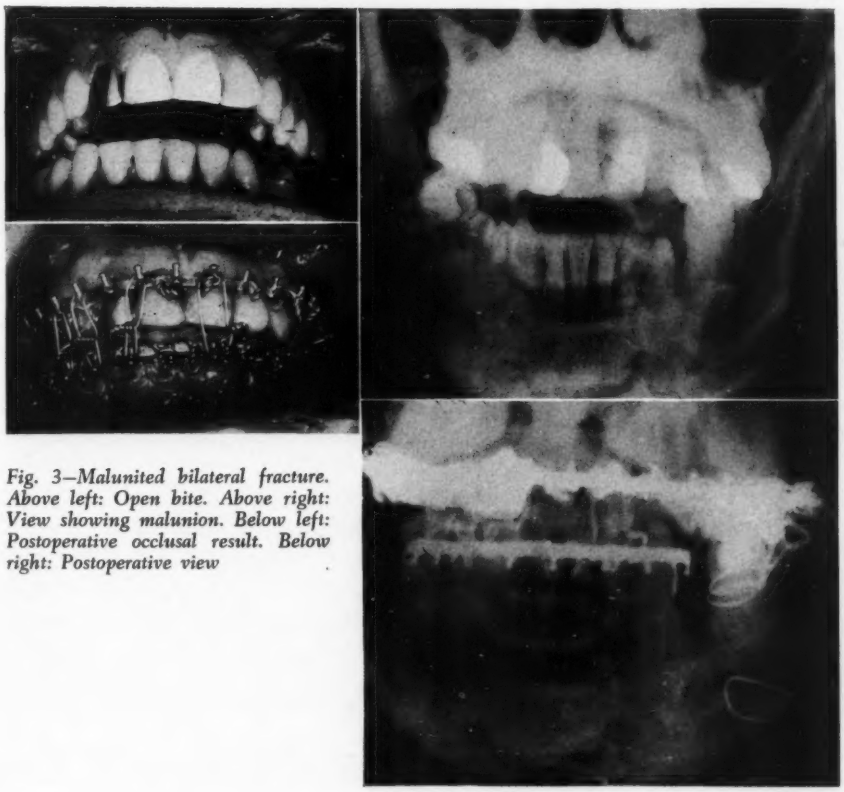

Fig. 3—Malunited bilateral fracture. Above left: Open bite. Above right: View showing malunion. Below left: Postoperative occlusal result. Below right: Postoperative view

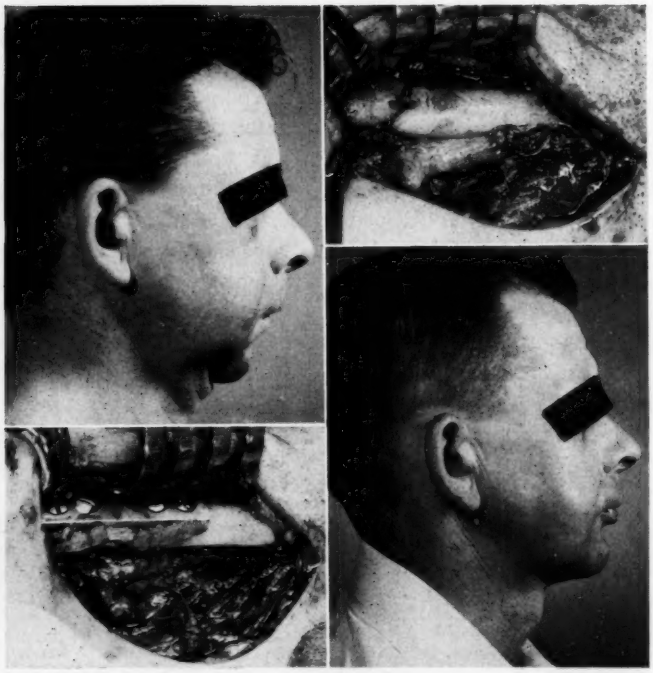

Fig. 4—Malunited fracture with facial deformity. Above left: Retrusion of mandible. Above right: Exposed fracture site. Below left: Distraction with insertion of bone chips. Below right: Postoperative view

cept for three or four days to prevent secondary hemorrhage.

If, on the other hand, a cross-bite or an open bite has developed, corrective measures are needed. The replacement of the posterior teeth if they have been lost, and in some instances overcorrection by raising the bite in the molar region and applying elastics in the anterior portion of the mouth will correct these deformities. If a retruded open bite has been well established and is fixed by scar contraction, functional treatment may not accomplish much. In instances of cross-bite, a bite plate may be helpful. In most instances, lysis of the adhesion by an open operation may be necessary and, if combined with exercises, gives satisfactory results.

Arthroplasty may be indicated in refractory cases. Smith and Robinson[2] recommended the insertion of an iliac bone graft the shape of a condyle between the freshened lower fragment and the débrided articular fossa. After a metal onlay

2. Smith, A. E., and Robinson, M. New surgical procedure in bilateral reconstruction of condyles, utilizing iliac bone grafts and creation of new joints by means of non-electrolytic metal. Preliminary report. Plast. & Reconstruct. Surg. 9:393 May 1952.

is attached to hold it in place, the graft is allowed to heal with the teeth wired into occlusion. Later a slot is cut at the point of union of the graft to the ramus and covered with an onlay made of non-electrolytic metal with a small tab turned downward so as to be able to fix it to the ramus by means of a screw. This assures normal centric occlusion and a hinge type of mobility of the jaw.

REPORT OF CASE—A woman 34 years of age had had a unilateral fracture dislocation. The resulting trismus had produced a cross-bite. Intermaxillary fixation was applied by the dentist on the basis that in the lateral jaw roentgenogram, the condyle appeared in fairly satisfactory position (Fig. 5, above left). When the wiring was removed after six weeks, however, the patient had limitation of motion and the cross-bite persisted (Fig. 5, above right).

No doubt scar contraction had drawn the mandibular end of the fracture up against the articular surface, because it

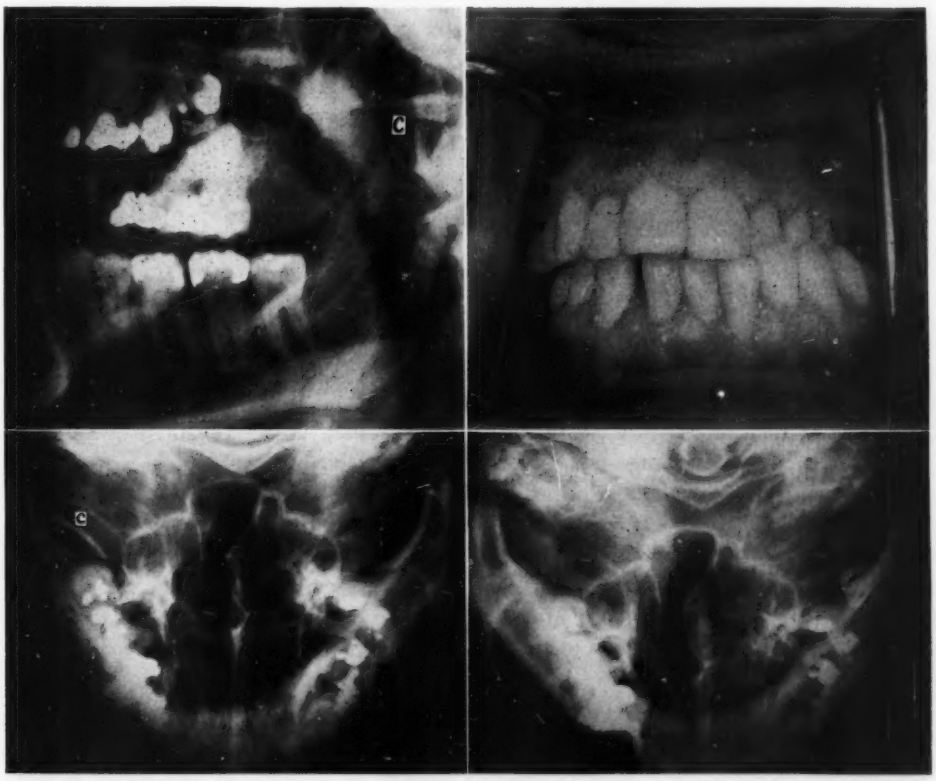

Fig. 5—Malunion in fracture dislocation. Above left: Lateral view. Above right: Cross-bite. Below left: View from base of skull showing displaced condyle. Below right: Condyle excised

was unopposed by the condylar fragment which was completely displaced, as seen in additional roentgenograms taken later (Fig. 5, below left).

Because the condyle also interfered with opening the jaw and caused pressure against the second division of the fifth nerve, a condylectomy was performed (Fig. 5, below right). Exercises and the use of a bite plate restored normal occlusion. This case also demonstrates the great importance of roentgenograms taken from various angles and the hazard of relying on lateral views alone.

■ *Ununited Fractures*

Nonunion of a fracture refers to a condition in which there is movement in the fracture site. This condition is caused if fibrous instead of osseous union takes place. Of the various causes, local factors are far more important than systemic conditions.

LOCAL CAUSES—The following are local factors which often cause nonunion:

1. Poor reduction should be mentioned first. Fractures that are treated by intermaxillary wiring alone often are poorly reduced, the operator being principally concerned with a good occlusal result. If the fracture is not properly impacted, or if muscle, a tooth fragment, or spicule of bone is in the fracture line, union is likely to be delayed or it may be prevented.

2. Ineffective fixation of the fragments is one of the most frequent causes of nonunion. It occurs most often in fractures posterior to the dental arch when fixation of the posterior fragment presents some difficulty. Even if the reduction looks adequate in the first postoperative roentgenogram, displacement may still occur later if the posterior fragment is not properly controlled, as is often the case if intraoral appliances alone are used for immobilization. Muscle pull produces constant tension during swallowing and talking. Even internal fixation of these fractures may result in nonunion, especially if too much metal is inserted (Fig. 6) or if a bone plate is applied incorrectly. It is important to remember that intraosseous wiring pulls the fragments together whereas bone plates may keep them apart. In actual practice the most important use of bone plates is for the maintenance of space to lengthen the bone. The space, of course, must be filled with bone chips.

3. Infection comes next as a factor in preventing union or in delaying it. If the infection is mild, it prevents the formation of osteoblasts and aids in the production of avascular fibrous tissue which has lost the power of osteogenesis. In active suppurative infection, the vitality of the bone is destroyed. Resorption of bone causes large excavations at the ends of the fragments in which pieces of dead bone often are located, causing a continuance of the infectious process in spite of antibiotic therapy. After such sequestra are removed, the ensuing bone defect cannot be bridged over, and scar tissue forms which causes contraction and often displacement of the fragments and prevents complete union of the bone (Fig. 10, above left). Usually, when the infection is eliminated, the ends of the fragments become eburnated, a condition which may produce a pseudarthrosis.

SYSTEMIC CAUSES—There are a number of factors which cause a delay of union while others prevent it altogether.

1. The age of the patient plays an important role. In healthy young persons fractures heal promptly, whereas in those of advanced age the reparative processes are slow and often incomplete, especially if the patient suffers from a debilitating disease. Blood transfusions given every other day are often helpful, and vitamin therapy is important in such instances.

2. Vitamin deficiencies should be recognized. In rickets and osteomalacia, bone calcification is interfered with. Scurvy and minor ascorbic acid deficiencies are especially important. Wolbach and Howe[3] demonstrated that fractures fail to heal in guinea pigs placed on experimental scorbutigenic diets. Osteoblasts are absent, and there is no formation of bone matrix. Repair, however, proceeds rapidly if ascorbic acid is added to the food.

Prolonged administration of antibiotics may cause an excessive elimination of vitamins and hormones or a decreased production due to destruction or alteration of the intestinal flora; therefore the diet should be supplemented with vitamins in patients requiring prolonged antibiotic therapy.

3. Normal protein metabolism is also of great importance, especially in older persons. To form bone matrix, the protein metabolism must be normal. Goldman[4] showed by means of animal experiments using monkeys placed on protein-free diets supplemented with vitamins that protein deficiency causes osteoporosis of the skull and jaws, protein synthesis being insufficient to form bone matrix. Histologically there was a cessation of osteoblastic activity with a tendency toward fibrous replacement of the marrow.

Fig. 6—Infected fracture with nonunion. Fistula discharged pus for over one year in spite of penicillin therapy because of too much wiring in presence of infection

4. Androgens and estrogens are known to have an important effect on protein and bone metabolism. Deficiencies, especially in the elderly of both sexes, are likely to cause osteoporosis. Asthenic, prematurely aging persons may be similarly affected. The anabolic synergistic effects of androgen and estrogen on protein and bone metabolism in such patients are an increase in protein and calcium retention and the formation and repair of bone matrix. The combined androgen-estrogen therapy prevents the side effects seen by the administration of the individual hormones. The use of conjugated estrogen substances with methyltestosterone is recommended. Increasing

3. Wolbach, S. B., and Howe, P. R. Intercellular substances in experimental scorbutus. Arch. Path. & Lab. Med. 1:1 Jan. 1926.

4. Goldman, H. M. Effects of dietary protein deprivation and of age on periodontal tissues of the rat and spider monkey. J. Periodont. 25:87 April 1954.

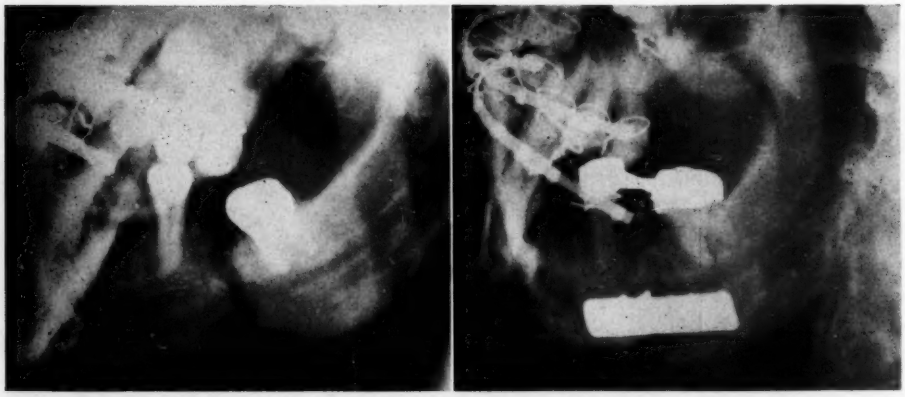

Fig. 7—Ununited fracture. Left: Before treatment. Right: After drilling, insertion of chip grafts and plating

the dietary protein favors the success of this type of therapy.

CLINICAL OBSERVATIONS—Nonunion, as has been pointed out, is a fibrous union which allows a certain amount of mobility of the fragments. The patient complains of pain when eating solid food. There may be a fistula discharging a slight amount of pus if an infection has not been completely eliminated, and sometimes a sequestrum or tooth is present in the fracture line. On examination, motion at the fracture site is easily demonstrated by bimanual manipulation of the fragments.

Nonunion of condylar fractures is uncommon; they generally heal well. Malposition is a greater problem than nonunion. If no treatment is given, however, nonunion with pseudarthrosis may result. When asymptomatic, pseudarthrosis permits good function. Sir Kelsey Frye[5] of the Maxillo-Facial Center at East Grinsted, England, even recommends the surgical establishment of a pseudarthrosis in instances of severe temporomandibular joint conditions. If the patient suffers pain, however, a condylectomy may be needed since the symptoms probably arise in the old joint and not from the pseudarthrosis. A case illustrating the results of condylectomy in this kind of condition has been reported previously.[1]

TREATMENT OF NONUNION—The treatment of nonunion may be a very simple procedure. Drilling of the bone to stimulate bleeding combined with firm immobilization of the fragments may be sufficient in some instances. In others the use of chip grafts to promote bone formation or the use of an onlay graft to bridge a larger gap may be required.

Bone Drilling—Drilling of the bone may be performed intraorally, although an extraoral approach is preferable since

5. Thoma, K. H. Displacement of condyle in fracture-dislocations of the mandible. (Discussion by Cahn, L. R.). Oral Surg., Oral Med. & Oral Path. 8:774 July 1955.

it gives better access to the body of the mandible. The fracture site is exposed through a small incision, and oblique holes are drilled from the cortex to the fracture surface (Fig. 8, center left). A number of holes should be drilled in each fragment without causing injury to the inferior alveolar nerve. These holes produce small blood clots in the bone and in the scar tissue between the fragments. New connective tissue develops in which osteoblasts form that will lay down bone trabeculae. To obtain good bone union, great care must be taken to immobilize the fragments properly. A dental splint cemented to teeth in each fragment, if

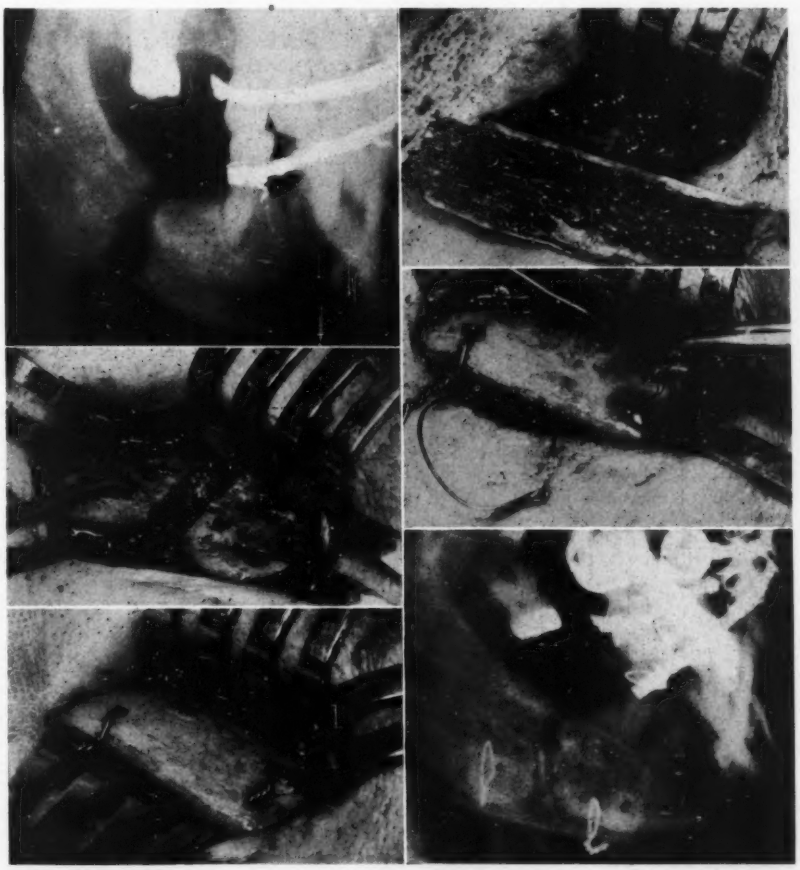

Fig. 8—Ununited fracture with loss of bone. Above left: Before treatment. Above right: Rib split on one side. Center left: Fragments decorticated and drilled. Center right: Graft being attached with stainless steel wires. Below left: Attachment of graft completed. Below right: After drilling and application of rib graft

present, and a bone plate with bone chips may be combined with intermaxillary fixation to produce adequate correction of the nonunion.

Chip Grafts—Chip grafts should be used when there is a slight bone deficiency after properly positioning the fragments. The fragments should be immobilized with a bone plate attached with two screws on each side. The chips are then packed into the fracture space and may also be applied on the outer surface on each side of the bone plate (Fig. 4, below left). Again the mandible must be completely immobilized.

Report of Case—A 32 year old patient had sustained bilateral ununited fractures of the mandible. On one side (Fig. 7, left) drilling was used and a bone plate was applied to fix the posterior fragment in good position (Fig. 7, right). Bone chips were placed between the fragments and over the surface of the bone.

On the other side, where a considerable amount of bone had been lost (Fig. 8, above left), a rib graft (Fig. 8, above right) was applied on the decorticated drilled mandible (Fig. 8, center left). Bone chips were placed into the bone cavity and the rib graft was attached (Fig. 8. center right and below left). The mandible was immobilized by intermaxillary fixation (Fig. 8, below right).

Onlay Grafts—Onlay grafts should be used if a large deficiency of bone exists and in fractures of an atrophic mandible in which the bone has to be strengthened (Fig. 9). A rib graft gives good results in most instances, but in those instances in which a considerable part of the mandible has been lost, as in gunshot injuries, an iliac graft may restore the lost bone more adequately.

Principles of Bone Grafting—In bone grafting, certain principles must be carefully observed. These have been reviewed recently by Kazanjian.[6] One of the most important steps is the repositioning of the fragments which are generally displaced by muscle pull and retained by scar contraction (Fig. 10, above left). This procedure requires careful resection of the scar tissue, without perforating the oral mucosa, and supplying adequate support for the fragments in the new position. This support refers particularly to the maintenance of the space between the fragments. In some instances I have used pin and clamp fixation to maintain the distracted fragments (Fig. 10, above right and below left). In other instances the graft itself, if properly attached, may hold the fragments in position, particularly if a piece of it is wedged between them. This piece may be a separate piece, or the graft, such as a rib graft, may be split on each end where it is to lie on the decorticated mandible while the whole rib is wedged between the fracture ends. It is of greatest importance that the graft should be in close contact with an adequate area of decorticated mandible on both sides (Fig. 8, above right, center and below) so that the recipient bone has a good blood supply.

Bone grafts are successful only if they

6. Kazanjian, V. H. Symposium on maxillofacial surgery; bone transplanting to the mandible. Am. J. Surg. 83:633 May 1952.

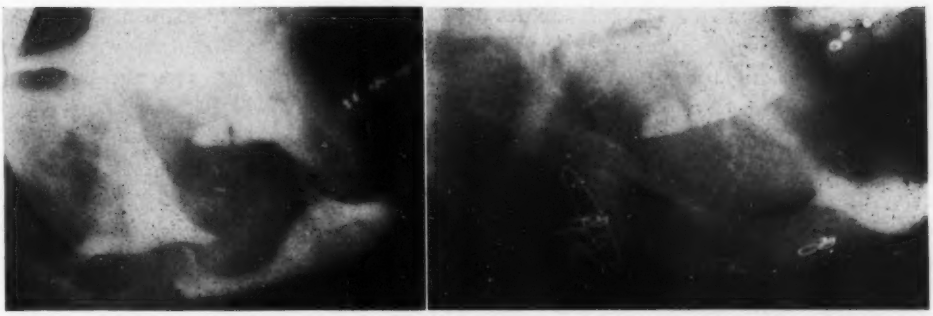

Fig. 9—Atrophy of mandible with pathologic fracture. Left: Preoperative view. Right: Rib graft

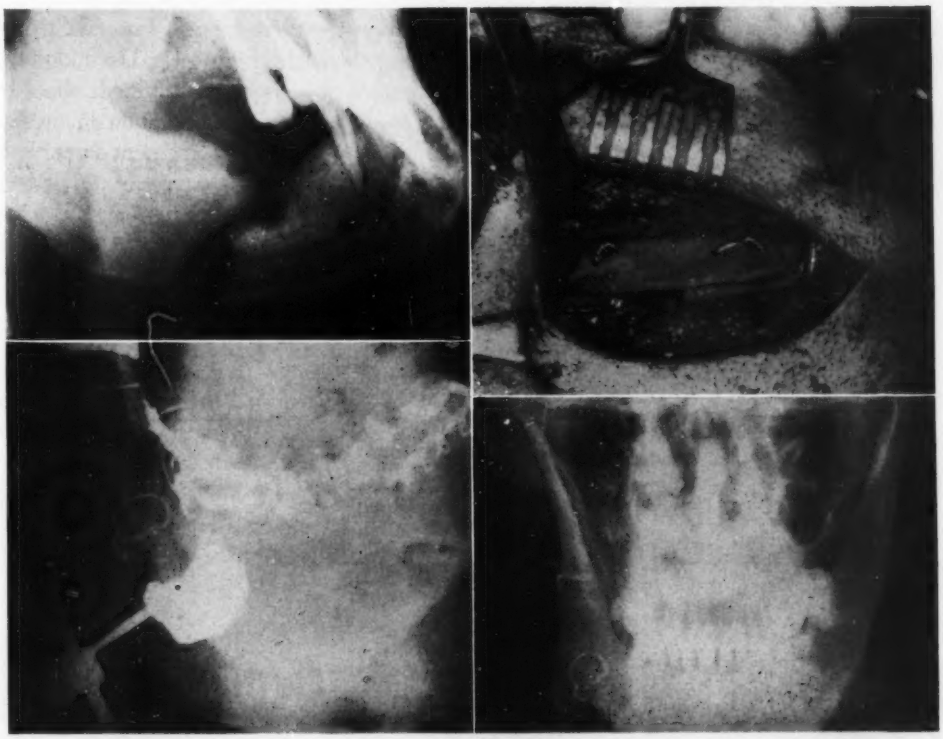

Fig. 10—Ununited fracture with displaced ramus. Above left: View showing ramus pulled superiorly. Above right: Rib graft attached and held with clamps. Below left: Postoperative view showing clamp fixation. Below right: Postoperative view several months later

are properly revascularized by anastomoses between vessels in the graft and the vessels in the mandible, or by penetrating ingrowth of host capillaries which tend to replace the old vascular system of the graft. The need of a good blood supply cannot be overemphasized. Stainless steel wire used in the manner of mattress sutures may be applied vertically or horizontally to hold the graft in contact with the mandible (Fig. 10, above right).

Report of Case—A 43 year old man had an ununited fracture of the mandible produced by a fist blow nine months previously. A combination of inadequate fixation and infection with resultant sequestration was the cause of the loss of bone. The ramus had been pulled superiorly so that the inferior border of the posterior fragment became united to the fracture surface of the anterior segment (Fig. 10, above left). After the fragments were freed by careful dissection, the posterior one was repositioned. Both fragments were decorticated and a split rib applied and held in contact with stainless steel wires (Fig. 10, above right). Thoma clamps were used with a Frac-Sure bar to hold the space (Fig. 10, below left). A small piece of rib was wedged into the space on the lingual side of the jaw. The postoperative roentgenogram taken 17 months later is shown in Fig. 10, below right.

Immobilization—Immobilization of the mandible is just as important as proper fixation of the fragments. Intermaxillary wiring serves the purpose and in addition secures a good occlusal result. It should be applied before the operation in order to position the anterior fragment correctly.

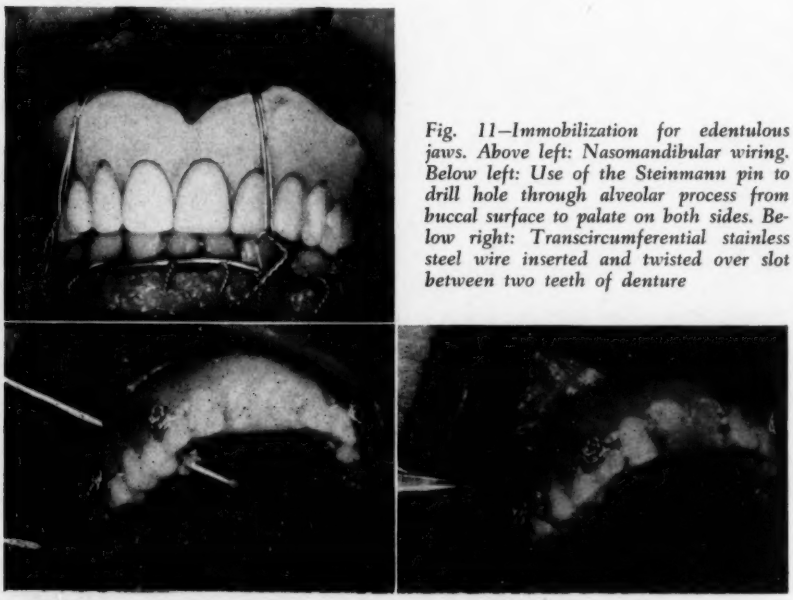

Fig. 11—Immobilization for edentulous jaws. Above left: Nasomandibular wiring. Below left: Use of the Steinmann pin to drill hole through alveolar process from buccal surface to palate on both sides. Below right: Transcircumferential stainless steel wire inserted and twisted over slot between two teeth of denture

Fig. 12—Rib and skin grafts with implant denture. Left: Rib graft. Center: Skin graft with implant denture inserted. Right: Denture inserted

Edentulous patients present special problems of immobilization. If the patient wears an upper denture, it may be locked between the jaws by means of nasomandibular wiring.[7, 8] Stainless steel wires are drawn through the margin of the piriform aperture and attached to an arch band wired to the lower teeth (Fig. 11, above left). If the edentulous patients have complete dentures, the dentures may be used as splints. The lower denture may be attached by circumferential wiring to the mandible, while the upper denture is fixed to the maxilla by transcircumferential wiring, as shown in Figure 11, below left and right. After both dentures are attached, the ends of the upper transcircumferential wires are twisted with the ends of the lower circumferential wires so as to lock the dentures together. A feeding space may be provided by the removal of the central incisors from the dentures.

If no dentures are available, a Gunning splint may be constructed. This splint is attached to the mandible by means of bilateral circumferential wires. It is then locked between the jaws by the method of nasomandibular wiring described.[9]

Denture Construction—Denture construction is a severe problem in some patients having large bone grafts, such as those with war injuries in which a considerable part of the mandible has been replaced. In such instances a secondary oral operation to improve conditions for the proper retention of dentures may be needed. In other instances, implant dentures may be used.

Report of Case—A war veteran with a bone graft (Fig. 12, left) and a skin graft over the mandibular ridge (Fig. 12, center) had an implant denture inserted at the Providence, R. I. Veterans Administration Hospital with satisfactory results. During the observation time of one year, the skin graft gave better adaptation around the pontics than the mucosa does ordinarily. The implant itself was firm, and the denture retention was excellent (Fig. 12, right).

7. Thoma, K. H. New method of intermaxillary fixation for jaw fractures in patients wearing artificial dentures. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 29:433 Aug. 1943.

8. Thoma, K. H. New methods for immobilization of the mandible. Oral Surg., Oral Med. & Oral Path. 1:98 Jan. 1948.

9. Thoma, K. H. Oral surgery, ed. 2. St. Louis, C. V. Mosby Co., 1952, ch. 7, p. 415.

■ *Summary*

The causes of nonunion of fractures are delay in treatment, inadequate roentgenographic examination, inexperience of the surgeon and infection at the site of fracture resulting in loss of bone.

Malunion occurs most frequently in the region of the angle of the jaw at the point where the fragments overlap. If treatment of malunited fractures is indicated, surgical revision with internal wire fixation is necessary. In instances of bone deficiency, bone grafts are used.

Nonunion of a fracture is a condition in which fibrous union allows a certain amount of mobility in the fracture site. Local causes are poor reduction, ineffective fixation of the fragments and infection. Systemic factors are age of the patient, vitamin deficiency, deficient protein metabolism, and hormone deficiencies. In the treatment of nonunion, drilling of the bone and immobilization of the fragments may be sufficient. Chip grafts may be required when there is a slight bone deficiency. Onlay grafts are necessary when there is a large bone deficiency or in instances in which bone must be strengthened. Immobilization for the edentulous patient may be achieved with the use of dentures wired together as a splint or, if no dentures are available, with a Gunning splint.—*1146 Beacon Street.*

Testimonial to Kurt Thoma

■ *Daniel J. Holland, D.M.D., Brookline, Mass.*

In every specialty there have been dedicated men whose contributions and sacrifices in behalf of that specialty have made the careers of those to follow easier and more secure. Kurt Hermann Thoma has served the dental profession with unusual distinction in two fields—oral pathology and oral surgery. Undisputedly, he is recognized as the father of American oral pathology and the most voluminous contributor to the literature of oral surgery.

Kurt Thoma was born 72 years ago in Basel, Switzerland, where he attended public and private preparatory schools and later studied engineering and architecture. He soon realized that the opportunities in engineering and architecture in a country the size of Switzerland were somewhat limited. While visiting an American dentist in Munich, he expressed an interest in studying dentistry and was advised to go to the United States and

Presented in behalf of the American Society of Oral Surgeons on the occasion of the presentation of the second American Society of Oral Surgeons Award to Dr. Thoma commemorating his contribution to the field of oral surgery, Los Angeles, October 15, 1955.

Kurt Thoma and plaque presented to him by the American Society of Oral Surgeons, October 15, 1955

receive an American dental degree. Subsequently, he registered at the Harvard University Dental School from which he was graduated with honors in 1911.

Shortly after graduation, he married Louise Bird of Newton, Massachusetts, and they embarked for Europe. It was about this time that local anesthesia, particularly the conduction technics, were receiving considerable attention on the European continent. While abroad, Dr. Thoma studied the entire field of local anesthesia and conduction injection technics, and when he returned to the United States in 1912 he received an appointment as assistant in the dental anatomy department of the Harvard University Medical School. He wrote a number of papers on local anesthesia and gave lectures and clinics before many local and state dental societies throughout the United States. His book, *Oral Anaesthesia: Local Anaesthesia in the Oral Cavity* appeared about this time and was the first dental book on the subject of local anesthesia.

At about this time, he also became interested in the theory of focal infection and pursued the ideas proposed by Sir William Hunter that abscessed teeth and other jaw and dental infections might possibly be the cause of or aggravate pathologic conditions elsewhere. After many papers and lectures on the subject of infection, his book *Oral Abscesses* appeared in 1916; this work also was the first dental book on the subject.

As a teacher at Harvard, he recognized very early the extreme importance

of the microscopic study of dental and oral diseases and was appointed lecturer on oral histology and pathology at the Harvard University Dental School.

Dr. Thoma was also extremely interested in the newer developments of the roentgen ray and had one of the first dental x-ray machines in the East. With his interest in and knowledge of oral pathology and with knowledge gained through his roentgenographic studies, he became a local expert in dental roentgenology. His book *Oral Roentgenology* was the result of this interest in this field.

In 1919, he was appointed assistant professor of oral pathology at the Harvard University Dental School and in 1934 was named the Charles A. Brackett Professor of Oral Pathology at Harvard University. Dr. Thoma continued his studies in oral pathology, collected a very large and complete microscopic slide collection and developed one of the earliest departments of oral pathology in any dental school in the United States.

His interest shifted to the diagnosis of oral diseases, especially tumors of the mouth, and in 1934 he published *Clinical Pathology of the Jaws*. This book was followed in 1936 by *Oral Diagnosis and Treatment Planning*. Thus, between the years 1918 and 1936 he made innumerable contributions to the literature on oral surgery and pathology and was even at this time perhaps the most widely quoted authority on dental diseases in the United States.

In 1941 the tome *Oral Pathology* was published. This was a gigantic undertaking and was the most complete and authoritative book on dental diseases with their gross and microscopic pathology that had ever been published. Since that time, this book has had several editions and has been published in several foreign languages. In 1941, he was also appointed professor of oral surgery at Harvard University and was made oral surgeon-in-chief of the busy clinic at Massachusetts General Hospital. As a result of this experience, his two-volumed book *Oral Surgery* was written. It was published in 1948 and since that time has had several revisions.

Since 1936, he had been the surgical editor of the *American Journal of Orthodontics and Oral Surgery* and was appointed editor-in-chief in 1941. In 1948, he was asked to be the editor-in-chief of a new journal entitled, *Oral Surgery, Oral Medicine and Oral Pathology*. The purpose of this journal was to enlarge the dental profession horizon. This journal soon filled a great need in the dental profession judging from the rate at which the subscription list increased in a short span of time.

These are merely a few of the contributions of this prodigious worker, for in the meantime he had carried on a busy practice and was also training men both in oral pathology and in oral surgery. Such endeavors did not go without reward. Fortunately, he has lived long enough to have received many honors. During World War I he served on the Selective Service Board for which duty he received the Selective Service Medal. He was also appointed a civilian consultant in oral pathology to the Army Institute of Pathology and civilian consultant in oral surgery to the Surgeon General, Department of the Army, in Washington, D. C. He is the civilian consultant in oral sur-

gery to the U. S. Public Health Service, the Veterans Administration, a diplomate of the American Board of Oral Surgery and of the American Board of Oral Pathology, of which he is the director.

His curriculum vitae lists almost 200 articles in the dental and medical literature in addition to 13 books bearing his name. He is a member of the Sigma XI and Omicron Kappa Upsilon, being past president of the Boston chapter. He is an honorary member of Psi Omega and an honorary member of the Dental Society of New South Wales, Australia, the Sociedad Dental de Guatemala, the Odontologic Society of Cuba and honorary president of the Asociacion de Cirujanos Orales de Cuba. He is an honorary member of the West Pennsylvania Oral Surgery Society and the Panhellenic Dental Society. At present, he is professor of oral surgery, emeritus, and professor of oral pathology, emeritus, of Harvard University. He is honorary surgeon and formerly oral surgeon-in-chief of the dental department at Massachusetts General Hospital, visiting lecturer and oral surgeon at the Graduate School of Medicine, University of Pennsylvania, surgeon to Brooks Hospital, consulting oral surgeon to the New England Baptist, New England Center, Faulkner, Beth Israel and other local hospitals.

He has received honorary degrees from the Royal College of Surgeons in England and the Royal College of Surgeons in Edinburgh. He gave the Tomes Lecture before the Royal College of Surgeons in 1949. He was recipient of the Jarvie Medal of the State of New York in 1950, the Pierre Fouchard Medal in 1951 and the Callahan Medal in 1951; therefore, this present honor not only of being selected to give the Chalmers J. Lyons Memorial Lecture, but also of receiving the American Society of Oral Surgeons Award, is most appropriate. Certainly there is no one in the field of oral surgery whose contributions have been so great, so many and so relied on. I am sure that this present honor added to the long list of others will bring Dr. Thoma comfort and satisfaction for a lifetime of hard work and fruition. Such awards are another way of saying "well done."—*1146 Beacon St.*

■ Two Contributions of Science

The science teacher should always teach that science has made two fundamental contributions to modern life: it has given man the choice between want and abundance; and it has freed him from irrational fear. Man has not quite conquered fear but through science he has freed himself from the tyranny of ancient superstition and is gradually coming to understand his own inner fears. The scientific conception of the nature of the world and of man can free man's mind just as the scientific control of matter and energy has freed his hands.–*Robert J. Havighurst, Sch. Sci. and Math. 44:120, 1944.*

A special problem in the field of oral surgery

■ *Daniel F. Lynch, D.D.S., Washington, D. C.*

During the past ten years, problems have been developing in the special field of oral surgery of which some oral surgeons seem to be unaware. In 1948 President Washburn of the American Dental Association, in his address to the House of Delegates,[1] pointed out that

> . . . the question of what constitutes oral surgery and who is to render the service, dentists or physicians, has come to the point where something must be done about it. Oral surgery was pioneered by dentists; it is and must remain in the hands of qualified dental practitioners.

Four years later, at the annual session of the Association in St. Louis in 1952, the House of Delegates approved the appointment of the first special committee to study the problems that were arising in the field of oral surgery. Members of that first committee were Otto W. Brandhorst, American Dental Association, chairman; Leslie M. FitzGerald, American Dental Association; James R. Cameron, American Board of Oral Surgery; Sanford M. Moose, American Society of Oral Surgeons; Harry Lyons, American Association of Dental Schools; William N. Hodgkin, American Association of Dental Examiners; Bert L. Hooper, Council on Dental Education, American Dental Association; Frank Hower, Council on Hospital Dental Service, American Dental Association; Philip E. Blackerby, Jr., Advisory Committee on Dental Specialties, W. K. Kellogg Foundation; Philip M. Northrop, representative of a regional oral surgery society; F. A. Pierson, representative of private general practice.

The excellent work done by this special committee of the American Dental Association in attempting to straighten out the misunderstandings between the two great health associations with respect to oral surgery can never be overlooked. Although several members of the American Society of Oral Surgeons served on that first committee, they served as individuals—not as representatives of the oral surgery society. The American Society of Oral Surgeons has been remiss in not appointing a committee on this problem so that the Society could share the heavy responsibilities which study and consideration of the problem entail.

The American Dental Association takes the position that oral surgery is an important branch of dental practice and, as such, the general practitioner in dentistry has an important stake in the problems affecting this specialty. Since all of these problems have by no means been solved, every oral surgeon should be in-

Presented before the American Society of Oral Surgeons, Los Angeles, October 12, 1955.

President, 1954-1955, American Dental Association.

1. Transactions, American Dental Association, 1948, p. 171.

formed of the background and of the work that has been done and is being done to prevent an irritating misunderstanding from developing into a major serious situation.

Dentistry is not alone in its concern over this irritant. For the last decade the American Medical Association has not been unmindful of the growing schism between the two professions. In June 1952 a resolution was introduced in the House of Delegates of the American Medical Association concerning the "need for and the desirability of close cooperation between the medical profession and the dental profession for the welfare of the patient. . . ."[2] The reference committee of the A.M.A. which considered this resolution significantly reported in part as follows:

> . . . your reference committee . . . recommends that the Board of Trustees of the American Medical Association confer with the American Board of Oral (Dental) Surgery to the end that a clear definition of medical and dental services be established. It must not be forgotten that only properly qualified physicians may practice medicine.

The first meeting of the American Dental Association Special Committee on Problems in the Field of Oral Surgery was held in Chicago on November 29, 1952, at which time primary attention was given to: (1) the development of a definition of the specialty of oral surgery; (2) the scope of the specialty of oral surgery; (3) recommendations for the revision of "Basic Standards of Hospital Dental Service Required of Approved Hospitals"; (4) recommendations for the revision of "Requirements for Approval of Dental Internships and Residencies," and (5) consideration of the action of the House of Delegates of the American Medical Association in regard to the scope of oral surgery.

The Committee prepared a definition of oral surgery and defined the scope of the specialty, both of which definitions were approved by the Board of Trustees and the House of Delegates of the Association.

> The specialty of oral surgery is that part of dental practice which deals with the diagnosis, the surgical and adjunctive treatment of the diseases, injuries and defects of the human jaws and associated parts.
>
> The scope of the specialty of oral surgery shall include the diagnosis, the surgical and adjunctive treatment of the diseases, injuries and defects of the human jaws and associated structures within the limits of the professional qualifications and training of the individual practitioner and within the limits of agreements made at the local level by those concerned with the total health of the patient.[3]

On March 21, 1953, the Association Committee on Problems in the Field of Oral Surgery met with officers of the American Medical Association at the Drake Hotel in Chicago at the request of the A.M.A. At this meeting the dental representatives presented to the medical representatives the foregoing definitions. In June of that year (1953) the Board of Trustees of the American Medical Association, which had accepted and approved these definitions, presented them to the House of Delegates of that organization. The A.M.A. House of Delegates did not

2. Board of Trustees report, supplement 1, to House of Delegates, September 1952, p. 1421.

3. Mimeographed report of Special Committee on Problems in the Field of Oral Surgery, American Dental Association, August 28-29, 1953, p. 10.

accept them, but, on recommendation of its reference committee, approved the following definition:

> Dental-oral surgery is to be limited to diseases of the teeth and jaws and lesions of contiguous soft tissues related to diseases of the teeth and jaws but excluding malignancies.

The House of Delegates of the A.M.A. further approved a recommendation ". . . that the oral (dental) surgeon be assigned to a surgical service of a hospital and perform such professional duties as the chief of the surgical service directed."[4]

In April 1954 the Special Committee on Problems in the Field of Oral Surgery met with representatives of the Board of Trustees of the A.M.A. and requested, among other things, that the House of Delegates of the A.M.A. rescind its "definition" of oral surgery, and that if the A.M.A. wished to adopt a definition of oral surgery for its own purposes, consideration should be given to the adoption of the definition approved by the American Dental Association.

The representatives of the A.M.A. Board of Trustees agreed to these proposals and accordingly transmitted them to its House of Delegates in June 1954. On the recommendation of the reference committee on medical education and hospitals, the House of Delegates refused to accept the recommendation of the Board of Trustees of that organization and recommended that:

> . . . the Board of Trustees appoint a committee representing all interests involved, including the section of otolaryngology, for the purpose of developing mutual understanding and agreement in regard to this important matter.

In substance, the House of Delegates of the A.M.A. turned the problem back to its Board of Trustees for further negotiations between the two associations.[5]

The House of Delegates of the American Medical Association, meeting in Miami, Fla., in November 1954, in effect reiterated its decision of the previous June and advised the special committee of the Board of Trustees to hold further meetings,

> . . . inviting particularly, representatives of groups officially representing the maxillo-facial surgeons and the dental profession, for the purpose of reaching, if possible, a common understanding with respect to a definition of dento-oral surgery.[6]

Thus, by the fall of 1954, and in spite of several conferences between representatives of the American Medical Association and the American Dental Association, no satisfactory agreement had been reached on the definition and scope of oral surgery.

The American Dental Association, however, continued to press for a solution. At the 1954 annual session of the Association, the House of Delegates adopted the following resolution:

> *Whereas*, the definition and scope of oral surgery has been approved and established by the House of Delegates, therefore be it
>
> *Resolved*, that the Board of Trustees be authorized to negotiate with the American Medical Association concerning any unresolved problems in the field of oral surgery.

4. Proceedings of the House of Delegates, American Medical Association, New York, June 1-5, 1953.

5. Reports of Officers and Councils, American Dental Association, 1954, p. 145-146.

6. Mimeographed report of February 5, 1955, meeting of representatives of A.M.A. and members of the Special Committee on Problems in the Field of Oral Surgery, American Dental Association, March 9, 1955.

The Board appointed a new special committee to negotiate with the American Medical Association. The personnel of this committee was as follows: Daniel F. Lynch, chairman, James R. Cameron, Leslie M. FitzGerald, Fred A. Henny, Paul H. Jeserich and O. J. McCormack.

On January 14, 1955, Dr. George F. Lull, secretary and general manager of the American Medical Association, invited representatives of the American Dental Association to a meeting in Chicago on February 5 to discuss problems related to the definition and scope of oral surgery. The report of this meeting was made to the Board of Trustees of the American Dental Association at its March 1955 meeting. The Board of Trustees then authorized the Special Committee to "make a formal request to the Board of Trustees and House of Delegates of the American Medical Association that its definition of oral surgery be rescinded."

Under date of May 10, 1955, the secretary of the Association, Harold Hillenbrand, addressed such a request to the American Medical Association but no formal reply was received until August 11, 1955.

The Board of Trustees of the American Medical Association, however, had given consideration to Secretary Hillenbrand's May 10th request because, at the annual session of the American Medical Association in June 1955, its Board of Trustees submitted the following report to its House of Delegates on the oral surgery question:

The Board of Trustees presents the following report of its Committee on Problems in Oral Surgery, in which one member dissents, and wishes to report that the Board concurs in the recommendations made therein:

The Committee met on February 5, 1955, the following members being present: Drs. Leonard W. Larson and Gunnar Gunderson. Absent members were Dr. Walter B. Martin, President, American Medical Association, Dr. Paul W. Greeley, and Lawrence R. Boies. Dr. Boies was represented by Dr. Gordon F. Harkness. Dr. J. G. Kostrubala was present as the representative of the American Society of Maxillofacial Surgeons. The American Dental Association was represented by the following persons: Dr. D. F. Lynch, President; Bernerd Kingsbury, President-Elect; Leslie M. FitzGerald; James R. Cameron; Fred A. Henny; Paul Jeserich; O. J. McCormack, and Harold Hillenbrand, Secretary.

The purpose of the meeting was to conciliate, if possible, the definition of oral surgery as adopted by the House of Delegates of the American Medical Association at its June 1953 meeting, and the definition of the American Dental Association.

At the June 1955 annual session of the American Medical Association, the Board of Trustees also reported to the House of Delegates:

It would seem to the Special Committee of the Board of Trustees of the A.M.A. that there is no good reason for the American Medical Association to define oral surgery.

. . . A careful search of the *Proceedings of the House of Delegates* of the American Medical Association during the past years fails to disclose any evidence to the effect that the American Medical Association has attempted to define the scope of activities of the various specialty groups within the field of medical practice, nor has it attempted or sought to define the scope of activities in the paramedical groups, including optometry, osteopathy, podiatry, et cetera, except as these groups have defined their own special fields of activity. It would, therefore, seem to your committee that there is no good reason for the House of Delegates to lay down a definition of dental-oral surgery, any more than it should attempt to define the scope of activity of any other specialty group.

The recommendation of the committee, therefore, is that it be recommended to the House of Delegates of the American Medical Association that the definition of dental-oral surgery as adopted in June, 1953, be rescinded. The reason for this recommendation is that there does not seem to be any possibility of reaching any agreement with the dental group in the light of the definition of oral-dental surgery established by the House of Delegates of the American Medical Association in June, 1953. The dissenting member, Dr. Lawrence R. Boies, Minneapolis, submitted a minority report, the pertinent paragraph of which is to the effect that it is his personal conviction that the definition of dental-oral surgery adopted by the House of Delegates of the A.M.A. in June, 1953, should not be rescinded.

The resolution of the Board of Trustees of the American Medical Association was referred to the Reference Committee on Insurance and Medical Practice which reported as follows:

In spite of the recommendation of the Board of Trustees, your Reference Committee believes it would be presumptuous to rescind this definition inasmuch as two previous Houses of Delegates have approved it. Your Committee therefore recommends that the Board of Trustees' report of June, 1955, be not approved and that the action taken by the House of Delegates in June, 1953, concerning this matter be reaffirmed. . . .

The report of the Reference Committee was adopted.

The House of Delegates of the American Medical Association was also asked to consider at its June 1955 session the two following resolutions introduced by the Illinois delegation:

Resolution No. 1

The following resolution was adopted by the House of Delegates of the Illinois State Medical Society on May 20, 1955:

Whereas, the efforts of the dental and oral surgical specialties have resulted in an encroachment on disease entities of the oral cavities and associated structures in the practice of their surgical specialty; now, therefore, be it

Resolved, that we, as members of the Chicago Laryngological and Otological Society, go on record as being unalterably opposed to this practice until the House of Delegates of the American Medical Association approves a properly worded resolution; and be it further

Resolved, that the Illinois State Medical Society looks with favor upon the definition of oral surgery as put forth by physicians in contrast to dentists.

Resolution No. 2

The following resolution was adopted by the House of Delegates of the Illinois State Medical Society on May 20, 1955:

Whereas, the Joint Commission on Accreditation of Hospitals on December 5, 1953, established standards for the dental staff of hospitals as follows:

"The dental staff shall conform in general to standards established for the medical staff. In addition:

"1. Members of the dental staff shall be graduates of approved schools of dentistry.

"2. Patients admitted for dental services shall be admitted on a surgical service and shall be the responsibility of the chief of that service.

"3. Adequate medical survey, by a member of the service to which admitted, shall be done on each patient before dental surgery. Indicated consultations shall be held in complicated cases; and

Whereas, efforts are being made by members of the dental-oral surgery profession to encompass all the disease entities of the oral cavity and its associated structures in the practice of their surgical specialty; and

Whereas, efforts are being made to interpret the standard established for the dental staff of a hospital by the Joint Commission on Accreditation of Hospitals as to permit treatment beyond the limits of the present established dental activities, and

Whereas, this would seem to be contrary to the patient's interest; and

Whereas, at the A.M.A. House of Delegates meeting in Miami, Florida, a report was made defining oral dental surgery which provoked extensive discussion and at that time it was voted by the House of Delegates not to accept the present report, it was remanded that the Joint Committees be continued between the A.M.A. and the A.D.A. to work out a suitable definition and report back to the House of Delegates of the A.M.A., therefore, be it

Resolved, that the members of the Chicago Laryngological and Otological Society go on record as being unalterably opposed to any change in the standard as outlined by the Joint Commissions on Accreditation of Hospitals governing the dental staff until the House of Delegates of the A.M.A. approve a properly worded definition and resolution.

These two resolutions of the Illinois delegation were joined with the record of the Board of Trustees of the American Medical Association in the report of the reference committee which recommended reaffirmation of the definition adopted by the House of Delegates of the A.M.A. in 1953.

It is interesting to note that at this same session, the House of Delegates of the American Medical Association expressed strong disagreement with the program and operation of the Joint Commission on the Accreditation of Hospitals. In considering several resolutions relating to the Joint Commission, the reference committee of the A.M.A. House of Delegates reported as follows:[7]

Your reference committee has reviewed all of these resolutions, which in principle are similar and apparently reflect a widespread dissatisfaction with the present functioning of the Joint Commission on the Accreditation of Hospitals, possibly from bilateral misunderstandings. Therefore, your reference committee recommends that the Speaker of the House of Delegates be requested to appoint a special committee to review the functions of the Joint Commission on Accreditation of Hospitals to consist of seven members, none of whom shall be members of the Council on Medical Education and Hospitals or of the Joint Commission on the Accreditation of Hospitals. This special committee should be instructed to make an independent study or survey and report its findings and recommendations to the House of Delegates at the next annual meeting. All physicians and hospitals are urged to pass on to the special committee any observations or suggestions concerning the functioning of the Joint Commission on the Accreditation of Hospitals.

In connection with the discussion of the oral surgery question, each member of the House of Delegates of the A.M.A. was presented with a copy of an article, "An Enigma in Organized Medicine," by Gordon F. Harkness, M.D., delegate from the Section of Laryngology, Otology and Rhinology. The character of this article, which is a series of misstatements and contradictions can be assumed from the following paragraph:

. . . We all know the results of appeasement in life as when a British gentleman with his umbrella went to confer with Adolph Hitler and without arguing the pros and cons we know the results of appeasement at Yalta and Potsdam . . .

Dr. Harkness has long vociferously opposed permitting the dental profession to engage in oral surgery.

The president of the American Dental Association, as well as the chairman and secretary of the Council on Hospital Dental Service of the Association were

7. Report of Reference Committee on Medical Education and Hospitals. J.A.M.A. 158:840 July 9, 1955.

present on behalf of the American Dental Association at the A.M.A. meeting in Atlantic City in June 1955. The president briefly addressed the House of Delegates while the other two representatives attended the meetings of the reference committee. Little opportunity was given the dental representatives to explain the position of the oral surgeons, and the meager support given the dental testimony was limited to one or two members of the medical profession at the reference committee meeting.

The Special Committee of the American Dental Association, after studying the 1955 report of the Board of Trustees of the A.M.A., commented as follows:

> The Special Committee believes that the committee of the Board of Trustees of the American Medical Association acted in good faith, if without conviction, in presenting to the House of Delegates of the A.M.A. the new position agreed upon at the conference of the two Associations' representatives. It should be noted, however, that members of the Board of Trustees did not defend or explain their report when it was being considered by the House of Delegates of the A.M.A. with the result that the dental position was without the benefit of a medical spokesman.

The latest development in the discordancy which exists between the two branches of the healing profession is reported in letters exchanged during the late summer of 1955 by the secretaries of the two associations.

Under date of August 11, Dr. George Lull, secretary of the American Medical Association, addressed the secretary of the American Dental Association as follows:

> Formal Notice of Action by Secretary of the American Medical Association.
>
> This is to inform you officially of the action taken by the House of Delegates of the American Medical Association at its meeting in Atlantic City, June 6-10, 1955 in regard to the "definition" of "oral surgery."
>
> The Committee of the Board of Trustees (Dr. Gunnar Gunderson, Chairman), submitted a report which was transmitted to the House of Delegates with the approval of the Board.
>
> The House adopted the report of the Reference Committee on Insurance and Medical Service which read:
>
> "In spite of the recommendation of the Board of Trustees, your Reference Committee believes it would be presumptuous to rescind this definition inasmuch as two previous Houses of Delegates have approved it. Your committee therefore recommends that the Board of Trustees Report of June, 1955, be not approved and that the action taken by the House of Delegates in June, 1953, concerning this matter, be reaffirmed."

As a result of this letter from the A.M.A., the Special Committee of the A.D.A. held a meeting in Chicago on September 12, 1955, and authorized the secretary, Harold Hillenbrand, to make the following reply to Dr. Lull:

> This is in further acknowledgment of your letter of August 11 informing me of the action taken by the House of Delegates of the American Medical Association on the "definition" of oral surgery. My reply has been delayed owing to attendance at an international dental meeting abroad.
>
> The special committee of this Association (A.D.A.) which has been considering this matter has asked me to convey to you and your Board of Trustees (A.M.A.) its appreciation of the soundly reasoned report which was presented by the Board to your House of Delegates. The Special Committee is in complete agreement with the statement that "there is no good reason for the American Medical Association to define oral surgery." It is unfortunate in our view that your House of Delegates did

not accept the report of your Board of Trustees and the recommendation to rescind the "definition," for this failure will serve to maintain a needless issue between the two professions and, as well, it may also serve to place in jeopardy other activities in which the closest cooperation between dentistry and medicine is essential. It is also proper for me to point out here that the Association does not consider this issue as relating only to a small minority of dentists, but to the entire dental profession.

The members of the dental profession who practice oral surgery, of course, will continue to do so under the statutes of the various states and without regard for any pronouncements made by the medical profession. Your "definition," therefore, can only be a source of annoyance to dentists in their relations to hospitals and may depreciate the friendly and cooperative relations which now exist between dentist and physician as members of a local community and health team.

If you and other members of your Association wish to suggest some further action which may be effective in clearing up this issue between the two professions, you may be sure that representatives of the American Dental Association will be available for further consultation and conference.

To date there has been no reply to that letter.

The Special Committee of the American Dental Association does not believe that this is the time for hasty or ill-advised action. Instead an educational program should be devised and implemented, one intended for members of both the medical and dental professions. The Special Committee is fully aware that there can be no compromise on the definition of oral surgery as adopted by the House of Delegates of the American Dental Association.

This is the background from official reports of both Associations. At first it might appear as though one issue only was involved. It is now clear, however, that there are many more. The definition and the scope of oral surgery is one. The proper position of the dentist in the hospital is another. The relationship of dentistry to Blue Cross and Blue Shield is another, and the advisability of voluntary insurance companies paying dentists for dental services is another important field that should be investigated. In addition there are certain misunderstandings related to anesthesiology that must be clarified. These misunderstandings arise too frequently to be an accident. If the teaching of anesthesiology in dental schools is not improved, the right of the dentist to give general anesthesia may be curtailed. His right to make a physical survey or a physical examination and a differential diagnosis is also questioned in some quarters. In other words, some physicians feel that the only person who can perform these functions properly is one with an M.D. degree.

But what to do about it? I don't know what the American Society of Oral Surgeons is going to do about it, but I can tell you some things that should be done. First of all, I think our members who have an M.D. degree can aid greatly in making the aims and objectives of the oral surgeon clear to the medical profession. No ethical member of the dental profession now or ever will overstep the boundaries of his prescribed field of operation. It is the obligation of every member of the American Society of Oral Surgeons to make that fact known to his medical friends.

Before I go any further, I would like to compliment Edward C. Thompson's committee on anesthesiology. It has done

yeoman service and done a wonderful job of interprofessional education. Certain other members of this Society have helped also, but the rank and file of the American Society of Oral Surgeons have not done all they could do in this respect.

There are certain things that the American Society of Oral Surgeons should do. One is to work more closely with the American Dental Association. A permanent liaison committee should be appointed to work in cooperation with the parent organization. Of course, certain individual members of this Society are very active in the Association, but the Society itself has no official liaison with the American Dental Association. In the past, the major responsibility of representing oral surgery in the American Dental Association has rested with such men as George B. Winter, Leroy M. S. Miner, Howard C. Miller, Sterling V. Mead, Leslie M. FitzGerald, and many others. These men have been officials in the American Dental Association; they have been members of the Board of Trustees. Some have been president. At present, however, I am the last oral surgeon on the Board of Trustees of the American Dental Association, and I see no member of the specialty of oral surgery in line for any of the more responsible offices in the Association. As a matter of fact, too few oral surgeons are in the House of Delegates of the parent organization. More members of the American Society of Oral Surgeons should be delegates to the A.D.A. annual sessions.

Oral surgeons should be more interested in organized dentistry. They should hold office in the component and constituent societies. They should become delegates to the American Dental Association annual sessions. Above all, they should be informed on all of the major problems facing the profession of dentistry. Once they are informed, they can inform others—their fellow dental practitioners as well as their medical associates.

Correct information is easily available. First, there is THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION. Each monthly issue carries a fund of information on dentistry's problems and on the activities of the Association. Every member receives it. Every member should read it. Second, there is the American Dental Association *News Letter*. A subscription is a dollar and a half a year. It comes out every two weeks. Subscriptions should be sent to the Bureau of Public Information, American Dental Association, in the Central Office. The information bulletins that come periodically from the Association should be read thoroughly. Send for and read the *Reports of Officers and Councils* of the American Dental Association which comes out six weeks before each annual meeting. It contains a digest of the current problems in dentistry that will be considered at the annual session.

Immediately after the annual session of the Association, THE JOURNAL publishes a complete resumé of the actions taken and resolutions passed by the Association. The high lights of these actions also are published in the *News Letter*. Within a relatively short time after each annual session a full report of the policies that have been adopted are published in a volume know as the *Transactions*, copies of which are available on request. When a minimum of 25,000 members of the American Dental Association read these reports regularly each year, the dental

profession will be well informed.

Above all, every oral surgeon should attend the annual sessions of the American Dental Association. It does not matter whether he is a delegate. No member needs to be a delegate in order to contribute to the development of America's parent dental body. Each Tuesday of an annual session is put aside especially for member participation. On this day, any member of the American Dental Association can be heard before any of the reference committees. The reference committees are the heart and soul of organized dentistry. It is through them that the average member has his opportunity to help make policy for the dental profession.

In closing, it should be emphasized that the American Dental Association has a sincere willingness to cooperate with all societies such as the American Society of Oral Surgeons. It is up to the Society to cooperate officially with the parent body of dentistry more in the future than it has in the immediate past.

This is a scientific age. Members of the dental profession, as scientists, have more of an obligation today than at any other time in history to make their voices heard, not only in the councils of their professional societies but in the state and city legislatures and even in the Congress of the United States. Today there is only one dentist in the Congress. There are five physicians. There should be at least 25 members of Congress from each profession. The members of the health professions not only have great responsibilities in their own field of endeavor. They have great responsibilities in their country's social order. Tomorrow these responsibilities will grow greater.

The problems before the oral surgeons of this country, indeed, the problems before the entire dental profession, are not going to be resolved by debate. They are only going to be resolved by raising the standards of training and education of dentistry and its specialty of oral surgery and by informed leadership on the part of all members. The aims and objectives of the specialty of oral surgery are fundamentally sound. They are conceived and executed in the best interest of the patient. So long as oral surgery embraces them and so long as each member maintains them, the specialist in oral surgery and the patient whom he serves cannot be adversely affected.—*1678 Primrose Road, N.W.*

■ JOY OF PERFECTION

A great deal of the joy of life consists of doing perfectly, or at least to the best of one's ability, everything which he attempts to do. There is a sense of satisfaction, a pride in surveying such a work—a work which is rounded, full, exact, complete in all its parts—which the superficial man, who leaves his work in a slovenly, slipshod, half-finished condition, can never know. It is this conscientious completeness which turns work into art. The smallest thing, well done, becomes artistic.—*William Mathews.*

Use of hyaluronidase for extractions in patients requiring immediate dentures

■ *Frank C. Carothers, D.D.S., Garnett, Kan.*

Immediate insertion of dentures to preserve a normal appearance is insisted on by nearly every patient after extraction of the anterior teeth. Rather than reveal the absence of natural teeth and experience embarrassment because of alteration in facial outlines and speech, the patient prefers to endure considerable discomfort from the pressure of immediate dentures on gums that are swollen, tense and distorted by trauma.

Postoperative swelling and trismus always have been troublesome problems in oral surgery. If the teeth are removed under local anesthesia by the standard procedure, preoperative ballooning and distortion of lips and face by the anesthetic agent add to the complexities of extraction, and if a general anesthetic is used, the prosthodontist still must contend with traumatic edema, hematoma and trismus that usually occurs after any operation on the mouth.

Until Benzer[1,2] used hyaluronidase for absorption of tissue fluid accumulations in oral operations, the patient subjected to major dental procedures had no escape from such complications.

■ *Hyaluronidase*

Hyaluronidase, an enzyme derived from testicular extract, is what is termed a "spreading factor." It was described first by Duran-Reynals[3-5] in 1928. This substance was later identified by Chain and Duthie[6] as the specific agent that had been shown to depolymerize hyaluronic acid, believed the major chemical constituent of the connective tissue "ground substance."[7] By temporarily liquefying the natural barriers, hyaluronidase opens pathways in the tissues for freer diffusion and consequent absorption of fluids.

Benzer[1,2] found that by injecting hyaluronidase into regions of the face, jaws and neck swollen as a result of accident or surgery, edema was dispersed more rapidly from the site of trauma, induration was eliminated and fibrosis prevented. Injured lymphatics and capillaries regenerated more rapidly, and stasis was alleviated, with earlier healing and less danger of postoperative infection.

■ *Procedure*

TREATED PATIENTS—In the investigation to be described, 62 patients, 24 men

1. Benzer, P. Preliminary report on the use of hyaluronidase in the treatment of traumatic swellings. Oral Surg., Oral Med. & Oral Path. 4:1515 Dec. 1951.
2. Benzer, P., and Schaffer, A. B. Use of hyaluronidase in the treatment of traumatic swellings. Ora Surg., Oral Med. & Oral Path. 5:1315 Dec. 1952.
3. Duran-Reynals, F. Exaltation de l'activité du virus vaccinal par les extraits des certains organes. Compt. rend. Soc. de biol. 99:6 June 8, 1928.
4. Duran-Reynals, F. Effect of extracts of certain organs from normal and immunized animals on the infecting power of vaccine virus. J. Exper. Med. 50:327, 1929.
5. Duran-Reynals, F. Tissue permeability and spreading factors in infections. Bact. Rev. 6:197 Dec. 1942.
6. Chain, E., and Duthie, E. S. Identity of hyaluronidase and spreading factor. Brit. J. Exper. Path. 21:324 Dec. 1940.
7. Meyer, K., and Palmer, J. W. Polysaccharide of vitreous humor. J. Biol. Chem. 107:629 Dec. 1934.

and 38 women, ranging in age from 24 to 74 years, required the extraction of anterior teeth. In the majority of these patients, six teeth were removed from each jaw at one sitting.

Most of the patients were in fair to good general health. One was in poor health, in one diabetes was a complication, and one had syphilis (Wassermann 4 plus reaction). All the teeth to be extracted were in poor condition, and the surrounding tissues were diseased to some degree. The teeth were loose in 45 per cent of the patients, and in 64.5 per cent, extensive caries existed. Periapical infection was present in 71 per cent, periodontal infection in 93.5 per cent, and infection of the gingiva, usually chronic, in 77.4 per cent. In one patient, unusually extensive surgical procedures were required.

PREOPERATIVE ANTIBIOTICS — Since the virulence of the oral infection was not determined in any instance, it was routine practice to administer antibiotic medication one hour before beginning the operation. Each patient was questioned about a possible history of allergy or of previous treatment with penicillin. The majority of the patients had had penicillin in some form.

Fifty-eight (93.5 per cent) of the patients were injected intramuscularly with a combination of 600,000 units benzathine penicillin G, 300,000 units procaine penicillin, 300,000 units potassium penicillin, 250 mg. streptomycin sulfate and 250 mg. dihydrostreptomycin sulfate (Bicillimycin).

Usually the injection was made in the deltoid muscle. For persons with small thin arms, the antibiotic was administered in the buttock. In four of the patients, such medication was omitted (in three because oral infection was apparently mild and in one because of history of sensitivity to penicillin).

PREOPERATIVE SEDATION — Twenty-seven extremely nervous, apprehensive patients were given pentobarbital sodium, and three were given meperidine hydrochloride intravenously, just before the operation. The tolerance of the individual regulated the amount of the dose that was administered.

ANESTHESIA—Only one patient, an exceedingly apprehensive 30 year old woman with extensive caries, required general anesthesia. She received 1/8 grain of morphine in addition to the other preoperative medication.

For 61 patients, different kinds of local anesthetic were used (in 2 per cent concentration, with epinephrine 1:100,000 or 1:50,000, or some other vasoconstrictor). Results were good with all of the local anesthetics, but lidocaine hydrochloride appeared to be the most satisfactory. This observation agrees with the conclusions of Brown and Luduena[8] who studied the ability of various local agents to diffuse into and out of nerve tissue and found that lidocaine hydrochloride penetrated rapidly and that there was a significantly early recovery.

HYALURONIDASE—The hyaluronidase used in this investigation was Wydase

8. Brown, T. G., and Luduena, F. P. Penetrance of local anesthetics. Anesthesiol. 14:555 Nov. 1953.

in vials of 150 U.S.P. units.[9] Each vial was reconstituted with 1 cc. sterile normal saline, according to directions. In most instances, about 1/8 cc. was ejected from the cartridge of lidocaine to make room for the hyaluronidase solution. An eighth cubic centimeter of hyaluronidase solution (about 20 units) was then added to the cartridge of lidocaine, which already contained epinephrine.

TECHNIC WITH LOCAL ANESTHETIC—For 57 patients, hyaluronidase, 20 units, was introduced into each carpule, and for four, doses of ten units were used. Three carpules produced sufficient anesthesia for the complete operation for the removal of six upper anterior teeth in each of ten patients; four carpules were required in five patients; six were required for the complete operation when 12 anterior teeth were removed in 13 patients; seven were required in 23; 8 were needed in nine, and in only one were nine carpules necessary.

The anesthetic-hyaluronidase-epinephrine solution was infiltrated around the teeth, starting at about the region of the first bicuspid. One cubic centimeter was also injected into the mandibular foramen. At first there was a slight ballooning and distortion of the lips from the anesthetic, but this subsided in about five or ten minutes. By the time the teeth were extracted and the necessary surgery completed, all ballooning of the lips had disappeared (Fig. 1, above).

TECHNIC WITH GENERAL ANESTHETIC—The patient was anesthetized with thiopental sodium. Hyaluronidase, reconstituted in 10 cc. sterile normal saline or a local anesthetic solution, was then infiltrated around the teeth to be removed—5 cc. in the maxilla and 5 cc. in the mandible.

INSERTION OF DENTURES—The dentures, constructed from impressions taken at a previous sitting, were inserted immediately on completion of the surgical procedure. The patient operated on under general anesthesia was allowed to return to her home when consciousness had fully returned.

POSTOPERATIVE CARE—Each patient was supplied routinely with a sedative, to be taken if needed. They were instructed to return the following day for examination of the gingiva. At that time another injection of the antibiotic that had been used before operation was administered. Standard measures for treatment of postoperative irritation were employed as necessary.

■ *Controls*

There were 31 controls (24 women and 7 men), ranging in age from 25 to 70 years. Almost all were in fair to good physical condition; one patient had heart damage and another had anemia. In 32 per cent of the patients the teeth were loose, 68 per cent had caries, 71 per cent had periapical infection, 93.5 per cent had periodontal infection, and in 93.9 per cent the gingiva was infected.

Preoperative medication was con-

9. Wydase (lyophilized hyaluronidase) was supplied through the courtesy of Wyeth, Philadelphia. A U.S.P. unit is defined as the amount of hyaluronidase which will reduce the turbidity produced by 0.2 mg. of potassium hyaluronate in acidified horse serum to that produced by 0.1 mg. under assay conditions.

sidered unnecessary in four patients who were in fairly good physical condition, with only mild infection of the mouth. Sixteen patients received an injection of the antibiotic one hour before extraction; seven received the antibiotic and pentobarbital. An anemic patient also received an injection of vitamin K.

With 29 patients, the extractions were performed under local anesthesia; general anesthesia (intravenous thiopental sodium) was used with two.

In the majority of the control patients, six teeth were extracted from each jaw at one sitting. The remaining six teeth in the opposing jaw were extracted about ten days later. Ten to 12 carpules of the local anesthetic agents usually were required to induce the necessary anesthesia.

■ *Results*

HYALURONIDASE-TREATED PATIENTS —No immediate postoperative swelling was noted in 61 patients (98.4 per cent). In only one was there slight swelling of the lips at the time the dentures were inserted, and this disappeared in 24 hours. The patient reported that after all previous extractions she had experienced severe postoperative swelling and extraoral hematoma.

Examination of the patients 24 hours later revealed that 87 per cent had no swelling (Fig. 1, below). Eight patients (13 per cent) had slight swelling which soon receded. In all of these patients the teeth and surrounding tissues had been in particularly bad condition (one was the patient with syphilis; another was the one that had required unusually extensive surgical intervention).

Fig. 1—Above: Typical appearance of the gingiva immediately after completion of extraction in patients treated with hyaluronidase. Below: Twenty-four hours later, after removal of sutures. Note absence of swelling and pressure ulcers

No intraoral or extraoral hematomas developed in these patients.

Forty-seven per cent stated they had had no pain at all, although in most instances 12 teeth had been extracted at one sitting and considerable surgical manipulation had been necessary. Thirty-two patients reported they had had slight discomfort in the first 24 hours. One complained of moderate pain. No trismus had occurred in 96 per cent; 4 per cent said they had experienced slight stiffness.

POSTOPERATIVE MEDICATION — No medication was required after the operation in 4.8 per cent of the patients. Antibiotics alone were administered in 47 per cent, antibiotics with sedation in 46.6

per cent, and in 1.6 per cent sedation only was required. The syphilitic patient, however, received daily injections of the antibiotic preparation and pentobarbital sodium by mouth for several days.

Healing was unusually rapid in all instances. No pressure ulcers developed in 66.2 per cent (Fig. 1, below). One small pressure ulcer occurred in each of 14 patients (22.5 per cent), and 7 (11.3 per cent) had a few small lesions of this type. None caused much annoyance, and all healed promptly. There were no secondary infections, and no untoward effects in patients under treatment for systemic disease.

CONTROLS—Significant swelling occurred immediately after the extractions in 28 patients (90.3 per cent). Examination 24 hours later revealed that all patients had some degree of swelling. It was severe in 45 per cent, moderate in 44 per cent, and slight in 11 per cent. Intraoral hematomas developed in 93.5 per cent, and in five patients they were severe. Extraoral hematomas occurred in 40 per cent, and were severe in two patients.

All of the controls stated they had suffered significant to severe pain and trismus in the first 24 hours after insertion of the dentures. In 30 per cent, pain had been especially severe, and 13 per cent had suffered unusual stiffness of face and jaws.

Forty-four per cent of the patients required both antibiotics and sedation after the operation; 26 per cent required sedation only, 20 per cent received injections of antibiotics alone, and 10 per cent required no postoperative medication. For the anemic patient, the preoperative injection of antibiotics and vitamin K was repeated. Codeine, as well as pentobarbital sodium, was necessary in most instances, and in some, morphine was required. The two patients who were operated on under general anesthesia were detained in the hospital for 24 hours after the extractions had been performed.

The usual period of about two weeks was required for healing in almost all instances. In two, healing was even slower than usual; in only one could healing be considered rapid.

Pressure ulcers developed in 90.3 per cent of the control patients in the first 24 hours.

■ *Discussion*

Until I began to use hyaluronidase with local anesthetics, I employed general anesthesia, preferably thiopental sodium intravenously or nitrous oxide and oxygen, for extractions and surgical procedures in patients who requested immediate insertion of dentures. When hyaluronidase was used to correct postoperative swelling, however, local anesthesia has been so satisfactory that a general anesthetic has been necessary only for the occasional patient who was highly excitable and more than usually apprehensive.

When hyaluronidase is added to the local anesthetic solution, a smaller volume is required to produce the desired anesthetic result.[10,11] The patients who were given hyaluronidase required only one half to two thirds the amount used for the

10. Kirby, C. K.; Eckenhoff, J. E., and Looby, J. P. Use of hyaluronidase with local anesthetic agents in nerve block and infiltration anesthesia. Surgery 25:101 Jan. 1949.

11. Looby, J. P., and Kirby, C. K. Use of hyaluronidase with local anesthetic agents in dentistry. J.A.D.A. 38:1 Jan. 1949.

control patients. Anesthesia was prompt in onset and of adequate duration.

This investigation has shown that the immediate swelling, ballooning and distortion of the oral tissues commonly associated with the surgical procedures required in multiple extractions may be eliminated in almost all patients. Except for a temporary slight sagging of the facial muscles from anesthetization, the external appearance remains normal (Fig. 2, left and center). There is no postoperative edema or traumatic hematoma (Fig. 2, right). Intraoral and extraoral ecchymosis is absent, whereas in extractions without hyaluronidase, intraoral ecchymosis is almost inevitable.

Anemic patients have a tendency to secondary seepage into the loose facial tissues after extraction, which persists for several days. With such patients, special precautions must be taken otherwise a disfiguring discoloration of the cheeks, lips and chin is liable to develop in about 36 hours after extraction. The addition of hyaluronidase to the local anesthetic will prevent this condition in most anemic patients; however, a few may require an additional injection of hyaluronidase solution in about 24 to 36 hours. One woman, operated on after the termination of this study, had been hospitalized for correction of anemia some time previous to the time of the extraction. She did not include this fact when giving her case history, however. Discoloration of the lower cheek and jaw appeared in about 36 hours, but the fluid accumulation was soon dispersed on injection of 2.5 hyaluronidase solution (about 75 units) into the center and on the periphery of the involved region.

Most patients experience no pain

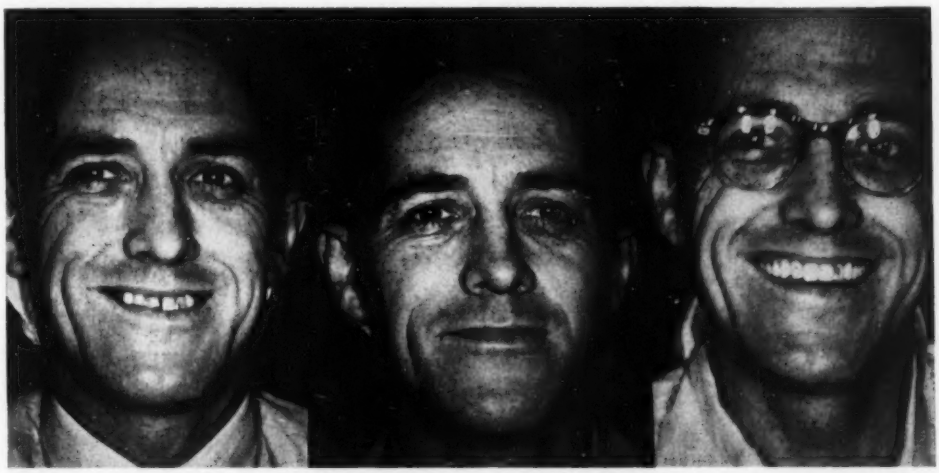

Fig. 2—A 43 year old patient who received 20 units of hyaluronidase per carpule of local anesthetic. Left: Appearance before dental operation. Center: Immediately after operation and insertion of dentures. Right: Twenty-four hours later. Note that there is no postoperative swelling or trismus. This patient was allergic to penicillin; no preoperative or postoperative medication was given

after operation. Snugly fitting dentures, therefore, may be inserted immediately since there is little risk of pressure ulcers or swelling and stiffness of the face and lip muscles developing.

The use of hyaluronidase with the local anesthetic is especially advantageous for extractions, filling, and other restorative work in children, since more profound anesthesia is produced with a smaller volume of the drug, and postoperative edema and swelling are avoided.

■ *Summary*

Anterior teeth were extracted, usually from both jaws, in 62 patients, 61 under local anesthesia and one under general anesthesia. Hyaluronidase was added to the local anesthetic, or infiltrated about the teeth when a general anesthetic was used. In the majority of the patients, antibiotics were administered one hour before and 24 hours after the operation. Sedatives were administered if necessary. A control series of 31 patients was also studied.

Anesthesia was rapid in onset and of adequate duration. Less of the anesthetic solution was required in the control patients. Immediate swelling, ballooning and distortion of the face and oral tissues were almost completely eliminated; there was no postoperative edema or hematoma, and no pain, or very little, in most instances. Healing time was noticeably reduced. Snugly fitting dentures were inserted immediately, with little irritation of the gingiva or stiffness of the lips or face. On examination 24 hours later, there was little tenderness and the mucous membranes appeared normal. In no instance was it necessary to grind away the dentures in the early postoperative period.

In the control patients, postoperative swelling developed immediately in 90.3 per cent and was present in 100 per cent 24 hours later. Intraoral hematomas occurred in 93.5 per cent, pain and trismus in all, and pressure ulcers developed in 90.3 per cent of these patients during the first 24 hours.

It is my opinion, therefore, that hyaluronidase should be used to prevent such complications after extraction of anterior teeth when immediate dentures are to be inserted.—*Carter Building.*

■ MEASUREMENT OF ACCOMPLISHMENTS

In fact, it would seem that only those who had some first-hand experience in the acquisition of new knowledge in some disciplined field would be able truly to appreciate how great the science of the past has been, and would be able to measure those giant accomplishments against their own efforts to penetrate a few millimeters further into the darkness that surrounds them.—*J. R. Oppenheimer.*

Bacterial resistance and cross resistance to antibiotics

■ *Irwin A. Small, D.D.S., Detroit*

Antibiotics are now among the most commonly used drugs. It has been estimated that the recent production of penicillin approached 200 tons a year and that of oxytetracycline, chlortetracycline, tetracycline and chloramphenicol about 90 tons. This wide usage during the last ten years has changed the clinical course of infections. Today an overwhelming invasion of the human body by any of the pathogenic bacteria is seldom seen.

The primary invaders in surgical infections 15 years ago were the hemolytic streptococcus and hemolytic *Staphylococcus aureus,* against which the human body had very little defense because of its inability to build up any immunity. Today, the gram-negative rods, including the colon bacillus, the typhoid bacillus, *Pseudomonas pyocyanea* and *Proteus vulgaris* are considerably more important. The hemolytic streptococcus and the hemolytic *Staphylococcus aureus* formerly were capable of spreading rapidly through the blood stream to almost any part of the body. These bacteria often produced multiple abscesses which in turn became foci for further general distribution. The regions most frequently involved in these metastatic abscesses were the liver, spleen, kidneys, lungs, and in young children, the long bones, and at times the brain, the heart, the joints, and other serous cavities. Such infections were frequent sequelae of trivial breaks in the surface epithelium of the body.[1]

■ *Development of Antibacterial Agents*

These infections were of such major importance that intensive studies were carried out from the earliest times to find out their cause and also to discover some way of terminating them. Ehrlich was the pioneer and chief advocate of research in this field, while most of those who followed in his footsteps became discouraged, and many, including Hata and Neufeld, predicted that no effective antibacterial agent could be found which would not be harmful to the body.

It was not until 20 years after Ehrlich's death that Gerhard Domagk, persisting in his search, finally found an agent that could stop the activity of hemolytic streptococci after their introduction into the human body, one that would not cause serious drug toxicity. Thus, the sulfonamides demonstrated that they could cut down both the mortality and the morbidity of hemolytic streptococcal infections. When this drug was applied in staphylococcal infections, however, it

Presented as a seminar to the faculty of Washington University Dental School, St. Louis, Jan. 1954.

1. Meleny, F. L., and Johnson, B. A. The clinical significance of the increasing resistance of organisms to the antibiotics. Surg., Gynec. & Obst. 97:267 Sept. 1953.

was found to be relatively inert, and staphylococcal septicemia and pyemia continued to occur, even with sulfonamide therapy.[1]

The successful clinical application of the drug by Leonard Colebrook and his co-workers soon after the discovery of Domagk, as well as its inexpensiveness and its unique action, soon made it popular and it was not long before it was being used indiscriminately, not only for hemolytic streptococcal infections, but for many other illnesses which were not infections at all.

Penicillin was discovered by Fleming in 1927, but his publications did not appear until 1929, and clinical application of this discovery was not made until ten years later by Florey and Chain. The difficulty and the high cost of production held back its development until the failure of the sulfonamides to live up to expectations. The failure in the treatment of war wounds and other infections encountered in the Army made the need for some other antibacterial agent urgent. Early observations of the effectiveness of penicillin against hemolytic streptococcal and staphylococcal infections gave hope of successful clinical treatment of infections occurring with war injuries. With that expectation, the Committee on Medical Research and the War Production Board, by subsidizing the pharmaceutical manufacturers, brought about the rapid and ever-increasing production of penicillin in the first years of World War II.

■ *Development of Resistant Organisms*

Penicillin soon proved to be no panacea. Although penicillin minimized the danger of invasive infection by both hemolytic streptococci and staphylococci, it was not able to prevent the local infection of wounds, either because organisms were present which were not susceptible to penicillin or because it was rendered inert at the site of local infection by the production of penicillinase. However, just as fulminating hemolytic streptococcal septicemias disappeared with the advent of sulfanilamide, the staphylococcal septicemias began to disappear as soon as penicillin became available. It is interesting to note that in those early days, patients with serious cases of septicemia were saved by the administration of 5,000 units every three hours for a total of 40,000 units a day.

It was not long before it was noticed that staphylococcal infections often required more than this amount to be controlled. An early paper by Lyons[2] stated that staphylococcal septicemia might require as much as 200,000 units of penicillin a day for adequate control. It may be that even at that early date the staphylococci were developing a resistance to penicillin. In the same manner that the medical profession had used sulfonamides indiscriminately, they now turned to penicillin with wishful thinking and applied it to everything that might be remotely caused by bacteria. It was not long also before patients, hearing of the "miracle drug," demanded that penicillin be used in the treatment of their illnesses. As a result, penicillin was used indiscriminately and frequently inadequately

2. Lyons, C. Penicillin therapy of surgical infections in the U. S. Army. J.A.M.A. 123:1007 Dec. 18, 1943.

which allowed resistant forms to be propagated.

Fleming, on his first trip to the United States, said that he feared that the indiscriminate use of penicillin aided the development of strains which would not respond to penicillin, and thus its effectiveness would be destroyed. Fleming's fears were justified. It was not long before reports[3] began to appear that the resistance to penicillin by staphylococci recovered from human infections was increasing from year to year. The percentage of strains of staphylococci resistant to penicillin reported in the early forties varied from 5 to 10 per cent.[4] Barber and Rozwadowska-Dowzenko[5] reported that the percentage of resistant strains isolated from hospital patients had increased from 41 per cent in 1946 to 60 per cent in 1948.

In more recent years, the introduction of the broad spectrum antibiotics has been followed by wide and indiscriminate use with the consequent development of increasing bacterial resistance to this group of drugs. Recent reports from various hospitals throughout the country verify the fact that an increasingly resistant bacterial population is developing. At Mt. Sinai Hospital, New York, in 1949, 9 per cent of the *Streptococcus fecalis* cultures isolated from infections were resistant to chlortetracycline. By 1951, this resistance had risen to 51 per cent.[6] No staphylococci resistant to chlortetracycline were recovered from patients in 1949, but 20 per cent of staphylococci recovered in 1951 were moderately resistant to this drug.[7]

It has been noted at some hospitals where the broad spectrum antibiotics are being used with increasing frequency that the number of staphylococci resistant to penicillin has decreased to some extent. This suggests that these antibiotics have killed many of the penicillin resistant strains, or that the use of the broad spectrum antibiotics actually has increased the susceptibility of the surviving organisms to penicillin.[1]

Lepper and Dowling observed that within one month of the adoption of erythromycin, strains of staphylococci resistant to it began to appear in the noses and throats of the staff. After five months the carrier-rate of highly resistant strains reached 75 per cent. The use of the drug was then discontinued, and two months later the carrier-rate fell to 37 per cent.

In 1952, Birnstingl, Shooter and Hunt[8] in England, observed that staphylococcal cultures obtained from hospital outpatients showed a 16 per cent resistance to penicillin, while over 50 per cent of inpatient hospital cultures of this organism were resistant. Several studies of penicillin and chlortetracycline resistant staphylococci have shown that hospital patients and personnel play an important role in the spread of antibiotic resistant bacteria.[8] Throat cultures of patients being discharged from hospitals show a higher percentage of resistant organisms than do

3. Finland, M., and Haight, T. Antibiotic resistance of pathogenic staphylococci; study of 500 strains isolated at Boston City Hospital from October 1951 to February 1952. A.M.A. Arch. Int. Med. 91:143 Feb. 1953.

4. Demerec, M. Production of staphylococcus strains resistant to various concentrations of penicillin. Proc. Nat. Acad. Sc. 31:16 Jan. 1945.

5. Barber, M., and Rozwadowska-Dowzenko, M. Infection by penicillin-resistant staphylococci. Lancet 2:641 Oct. 23, 1948.

6. Morgan, H. J., and Branscomb, B. V. Medicine of year; internal medicine. Am. Pract. & Digest Treat. (supp.) 4:34 April 1953.

7. Schneierson, S. S. Changes in bacterial sensitivity to aureomycin and chloramphenicol in the course of the past three years. J. Lab. & Clin. Med. 40:48 July 1952.

8. Birnstingl, M.; Shooter, R., and Hunt, M. Sensitivity to five antibiotics of strains of staphylococci pyogenes isolated from out-patients. Brit. M.J. 2:253 Aug. 2, 1952.

those of patients just entering.[9] The proportion of infections caused by resistant organisms is higher when such infections are acquired in the hospital than among those acquired in the community at large.

Lepper and co-workers, in the study made in hospitals of penicillin and chlortetracycline resistant staphylococci, described the epidemiology of these resistant organisms. The development of the resistant strains may occur as follows:

1. Strains of bacteria sensitive to the antibiotic and carried by a patient at the time the antibiotic is introduced may become resistant because of adaptation to the drug through the mechanism of natural selection or spontaneous mutation.

2. Strains which are resistant to the antibiotic at the time of its introduction, or those which subsequently become resistant, may be spread to other people.

3. A place in which large numbers of patients are treated with antibiotics at the same time is apt to become a center of infection from which antibiotic resistant staphylococci are brought into the community by patients after their discharge from the hospital.

4. Such infected personnel will infect persons who are not receiving antibiotics, but not to the same extent as they would persons in whom the more sensitive strains have been removed by antibiotic treatment.

5. In the community as a whole, where the effects of several such foci are diluted by the remainder of the population, antibiotic resistant strains may appear more slowly. In such instances, a slow increase in the percentage of resistant forms could occur without actual increase in resistance occurring in any single strain while patients are being treated.

6. It is possible that if there were any resistant strains in the community when a new antibiotic is introduced, even if there were no change in the sensitivity of any individual strains, a process of selective survival of the existing resistant strains could in time produce a predominantly resistant population.

7. Combinations of chlortetracycline and penicillin in treatment will limit the spread of organisms sensitive to one antibiotic and not to the other, but will increase the spread of organisms resistant to both if such organisms exist. It is likely that in time a focus of these organisms would be established, and the combination would then have lost its value.

Thus it is obvious that a dentist cannot always be certain that he is dealing with a sensitive organism when a patient gives no history of previous antibiotic therapy.

In the face of increasing bacterial resistance, there has been an equal increase in the amount of the drugs used in an attempt to control some diseases. Twenty million units of penicillin plus 4 Gm. of streptomycin daily for six weeks are being used regularly in the treatment of subacute bacterial endocarditis. As much as 100,000,000 units of penicillin daily and 6.5 Gm. of chlortetracycline daily have been used in some cases of bacterial endocarditis.[10] It is of special interest to note that the development of sub-

9. Lepper, M., and others. Epidemiology of penicillin and aureomycin resistant staphylococci in a hospital population. A.M.A. Arch. Int. Med. 92:40 July 1953.

10. Therapeutic use of combinations of antibiotics. New York State J. Med. 53:1228 May 15, 1953.

acute bacterial endocarditis after dental extraction is not always prevented by prophylactic penicillin; there are at least five failures reported in the literature.[11]

Perrin Long, in England in 1950, observed that it was unwise to give penicillin for an appreciable time before dental extraction because the bacterial flora of the mouth rapidly became penicillin resistant. Cates, Christie and Garrod[12] support this observation with a report of the death of a patient who was on a routine of two million units of penicillin a day for six days. Teeth were removed on the second and fourth day and the patient subsequently died. It seems likely that in this instance prophylactic penicillin actually induced an endocarditis more formidable than was the one against which it was expected to guard. It is only fair to observe, however, that nothing comparable occurred with 442 patients, many of whom had dental extractions at the end of long courses of treatment with penicillin. It is of interest to note that the dose of two million units daily is, as of 1951, the largest dose that has failed to prevent bacterial endocarditis after dental extraction.

■ *Cross Resistance Patterns*

It has been observed that bacteria made resistant to a specific antibiotic may develop simultaneously new properties, including changes in sensitivity to other antibiotic agents. Resistant strains may show lower, equal, or higher sensitivity than the parent culture to any antibiotic not used in their isolation. In addition to showing a cross resistance pattern to some antibiotics, resistant bacteria may demonstrate a reciprocal cross resistance pattern in which a strain made resistant to any one member of a group will show resistance to any member of that group.[13]

Szybalski and Bryson[14] have studied the comparative sensitivity of resistant bacterial strains to 34 antibiotics. They used *Escherichia coli* and *Staphylococcus aureus* in their study.[13,14] They are also studying the cross resistance pattern of *Mycobacterium ranae*. The slow growth rate of the tubercle bacillus has not permitted completion of the analysis with this organism.

Resistant strains were prepared by means of the gradient plate technic (Szybalski, 1952). Many of the antibiotics that they tested are too toxic for clinical use; therefore, they have been omitted from the present discussion. They found that the antibiotics tested fall into three internally related major groups.[14]

Group 1. Streptothricin, viomycin, polymyxin B, and neomycin. Bacteria resistant to these antibiotics show increased resistance to all others in this group and are also resistant to the streptomycins. Complete cross resistance exists between hydroxystreptomycin and other streptomycins.

Group 2. Chlortetracycline, oxytetracycline and chloramphenicol show a high degree of reciprocal cross resistance with *E. coli*. They are also more resistant to

11. Glaser, R. J., and others. Effect of penicillin on the bacteremia following dental extraction. Am. J. Med. 4:55 Jan. 1948.

12. Cates, J. F.; Christie, R. V., and Garrod, L. P. Penicillin resistant subacute bacterial endocarditis treated by combination of penicillin and streptomycin. Brit. M.J. 1:653 March 31, 1951.

13. Szybalski, W., and Bryson, V. Genetic studies on microbial cross resistance to toxic agents; cross resistance of Escherichia coli to 15 antibiotics. J. Bact. 64:489 Oct. 1952.

14. Szybalski, W. Genetic studies on microbial cross resistance to toxic agents. Cross resistance of micrococcus pyogenes var. aureus to 34 antimicrobial drugs. Antibiotics & Chemotherap. 3:1095 Nov. 1953.

penicillin. With *Staphylococcus aureus*, however, cross resistance between chlortetracycline and oxytetracycline, on one hand, with chloramphenicol and penicillin on the other, was not very evident.

Group 3. Bacitracin (bacterial polypeptide) shows no significant cross resistance with other antibiotics.

One phenomenon described in this study was that of "collateral sensitivity" in which a strain resistant to one antibiotic exhibits a considerably higher sensitivity than the original parent strain to another antibiotic.[13] The antibiotic that most resistant strains were sensitive to was polymyxin B. Another phenomenon demonstrated was the presence of strains of bacteria dependent on penicillin and chloramphenicol and streptomycin. It must be pointed out that the relationships just mentioned exist only with *Escherichia coli* and *Staphylococcus aureus*.

Evidence by other investigators has confirmed the occurrence of reciprocal cross resistance between chlortetracycline and oxytetracycline.[3,15-18] Most investigators believe that reciprocal cross resistance between chlortetracycline, oxytetracycline and chloramphenicol is unpredictable. Structurally there is a chemical similarity between chlortetracycline and oxytetracycline, differing only in that chlortetracycline has a chlorine atom in place of an hydroxyl group in oxytetracycline. Chloramphenicol differs from these two antibiotics, but cross resistance relationships to these three antibiotics have been established in certain microorganisms.[16-18]

Organisms resistant to neomycin have shown cross resistance to streptomycin, but the reverse is not true in most instances.[19] No direct relation has been found between carbomycin (Magnamycin), erythromycin and other major antibiotics. A reciprocal cross resistance relationship does exist, however, between carbomycin and erythromycin.[20,21] Preliminary studies with these two agents gave promise of usefulness against penicillin-resistant organisms. However, unpublished data by Fusillo and Pulaski indicate that a cross resistance can be established between penicillin and erythromycin if the organism originally is resistant[22] to broad-spectrum antibiotics.

In vitro studies to demonstrate cross resistance between penicillin and the broad-spectrum antibiotics (chlortetracycline, oxytetracycline and chloramphenicol) have proved fruitless.[16] Yet increasing numbers of organisms resistant to all four of these agents are being isolated.[3,23] The significance of this observation is not fully understood, and an indirect mechanism of cross resistance was suggested.[22]

15. Gocke, T. M., and Finland, M. Cross-resistance to antibiotics. Effect of repeated exposure of bacteria to aureomycin, terramycin, chloramphenicol, or neomycin on resistance to all of these antibiotics and to streptomycin and penicillin. J. Lab. & Clin. Med. 38:719 Nov. 1951.

16. Fusillo, M.; Romansky, M. J., and Kuhns, D. M. Further investigations on cross resistance as well as studies on induced sensitivity to antibiotics. Antibiotics & Chemotherap. 3:35 Jan. 1953.

17. Pansy, F., and others. Relationship between aureomycin, chloramphenicol and terramycin. Proc. Soc. Exper. Biol. & Med. 75:618 Nov. 1950.

18. Fusillo, M., and Romansky, M. Simultaneous increase in resistance of bacteria to aureomycin and terramycin upon exposure to either antibiotic. Antibiotics & Chemotherap. 1:107 May 1951.

19. Haight, T. H.; Wilcox, C., and Finland, M. Cross-resistance to antibiotics; effect of repeated exposures of bacteria to streptomycin or neomycin or resistance to both of these and to six other antibiotics. J. Lab. & Clin. Med. 39:637 April 1952.

20. Finland, M.; Wilcox, W. S., and Purcell, E. Cross-resistance to antibiotics: carbomycin and erythromycin. Proc. Soc. Exper. Biol. & Med. 81:725 Dec. 1952.

21. Fusillo, M., and others. Antimicrobial spectrum and cross-resistance studies of erythromycin and carbomycin. Antibiotics & Chemotherap. 3:581 June 1953.

22. Fusillo, M., and Kuhns, D. M. Cross resistance to antibiotics. U. S. Armed Forces M.J. 4:1600 Nov. 1953.

23. Miyahara, B. T.; Cariker, K., and Clapper, W. Cross resistance in staphylococci and the effects of antibiotics on resistant strains. J. Lab. & Clin. Med. 41:550 April 1953.

Many laboratories have demonstrated that penicillin-resistant staphylococci will lose this resistance when transferred to antibiotic-free media. Thus the common occurrence of penicillin-resistant staphylococci indicates the widespread indiscriminate use of this agent. Current studies with staphylococci resistant to chlortetracycline, oxytetracycline or chloramphenicol have not demonstrated this loss in resistance. Murray and co-workers[24] have shown that no loss occurred in streptomycin resistance after 100 serial transfers in antibiotic free media. Resistance to chlortetracycline, oxytetracycline, chloramphenicol and streptomycin appears to be relatively permanent.

■ *Mechanism Affecting Bacteria*

Many attempts have been made to determine the mechanism by which the antibiotics inhibit the growth of or destroy bacteria. It is generally believed that in some way they interfere with one or more of the metabolic processes of the organism; thereby the utilization and absorption of nutrient materials or the excretion of waste materials is prevented. There is much experimental work that remains to be done.

Mechanisms by which bacteria become resistant are being studied intensively. Some resistant staphylococci have the ability of producing penicillinase, which destroys penicillin.[3] Other staphylococci, either through synthesis of glutamic acid within the cell or by an alternate metabolic pathway not attacked by penicillin, are able to metabolize the essential growth factor whose elaboration is blocked in the sensitive strains.[1] Recent work by Smolens and Vogt[25] has demonstrated that strains of *Hemophilus pertusis* and *Staphylococcus aureus* grown on a media rich in desoxyribonucleic acid has resulted in a considerable increase in resistance to a number of antibiotics. This increase was accompanied by an increase in the ribonucleic acid content of the bacteria.

In the field of genetics, Demerec and his co-workers[4] have become interested in the problem of bacterial resistance to antibiotics. They concluded that:

> . . . resistance was not induced by the action of penicillin on bacteria, but originates through mutation, and penicillin acts as a selective agent to eliminate nonresistant individuals. The degree of resistance can be increased by exposure to higher concentrations of penicillin. This increase is interpreted as being due to a summation of the effects of several independent genetic factors for resistance which undergo consecutive mutation.

They conceived the idea that this takes place by means of several steps each time that the organisms come in contact with penicillin.

When Demerec's group[26] carried out similar studies with streptomycin and certain gram-negative organisms, they found that resistance developed rapidly. The organisms often became resistant after only one or two contacts with streptomycin, the steps in this case being very high. They almost might be called jumps. A great many workers have studied this prob-

24. Murray, R.; Wilcox, C., and Finland, M. Persistence of streptomycin resistance during subcultures in streptomycin free media. Proc. Soc. Exper. Biol. & Med. 66:133 Oct. 1947.

25. Smolens, J., and Vogt, A. B. Studies on antibiotic resistance and the nucleic acid content of bacteria. J. Bact. 66:140 Aug. 1953.

26. Bryson, V., and Demerec, M. Patterns of resistance to antimicrobial agents. Ann. New York Acad. Sc. 53:283 Sept. 15, 1950.

lem and patterns have been worked out for all of the commonly used antibiotics. Streptomycin seems to be in a class by itself, permitting as it does the rapid development of resistance by many of the gram-negative bacteria, while the other antibiotics in general follow the pattern of penicillin.

Eagle and his co-workers[27] who have studied bacterial resistance with great care, stated that

> . . . the development of increased bacterial resistance to antibiotics following exposure to the drugs has been demonstrated with every antibiotic and every bacterial species so far studied. In some instances the resistance of the strain gradually returns toward normal levels on repeated subculture in the absence of the drug. In other cases, the resistance remains essentially unchanged after hundreds of generations in antibiotic-free media. Two general mechanisms may be postulated for the development of this inheritable change. The resistant organisms may arise as spontaneous mutations which occur in the course of bacterial multiplication. These rare mutants would be present in the original culture, the drug acting as a selective factor. Most workers incline to this view. An alternative possibility is that increased resistance to antibiotics is not the result of a spontaneous mutation, but develops as a direct result of exposure to the drug and is an adaptive change which persists after its removal.

These two hypotheses are probably interrelated.

■ *Comment*

After years of search and intensive screening of thousands of substances and organisms for antibiotic activity, the yield has been very small. It is interesting that most of the major antibiotics nontoxic to man are derived from the genus *Streptomyces*. It would seem, then, that new, super antibiotics may not be the answer to the destruction of pathogenic bacteria. Rather, an increased study of bacterial metabolism and resistance to antibiotics is needed. An example of the type of research that may solve the problem of bacterial resistance was reported recently.[28] Numerous metabolites such as riboflavin and glycine were found to reverse the inhibition of *Escherichia coli* by penicillin, chlortetracycline, oxytetracycline, streptomycin and chloramphenicol. The best antibiotic reversal was found with riboflavin added to chlortetracycline. When a known inhibitor of riboflavin synthesis, dichlorodiaminobenzene, was added in small amounts to the test organism, only 1/16 the amount of chlortetracycline was required for inhibition. The addition of antimetabolites to antibiotics, termed "protected inhibition" by the authors, may provide a new weapon for antibiotic therapy.

From the evidence presented it seems apparent that certain antibiotics should not be selected as alternative choices in therapy. Chlortetracycline, tetracycline, oxytetracycline and probably chloramphenicol should not be used in combination or as an alternate. Neomycin and streptomycin should not be used successively, and erythromycin and carbomycin would prove ineffective against an organism resistant to one of them.

In oral and dental infection, penicillin is still the antibiotic of choice, even

27. Eagle, H.; Fleishman, R., and Levy, M. Development of increased bacterial resistance to antibiotics. Continuous spectrum of resistance to penicillin, chloramphenicol and streptomycin. J. Bact. 63:623 May 1952.

28. Foster, J. W., and Pittillo, R. Metabolite reversal of antibiotic inhibition, especially reversal of aureomycin inhibition by riboflavin. J. Bact. 66:478 Oct. 1953.

though the staphylococci have developed a widespread resistance to it. Unless laboratory sensitivity tests report a resistant organism or the patient is allergic, penicillin by hypodermic injection should be used empirically in prophylaxis and treatment of dental infection. No longer can a "shot gun" type of therapy be used rationally, and with the problems of resistance and cross resistance so apparent, laboratory sensitivity tests should be relied upon to determine the antibiotic of choice in the acute or critical case.—*20050 Votrobeck Court.*

Considerations in diagnosis of maxillary fractures

■ *Theodore A. Lesney, D.D.S., Honolulu, Hawaii*

It is improbable that bilateral fractures of the maxillae, with detachment of these bones from their cranial base, are solitary clinical entities. Rather, this type of fracture generally indicates that other bones of the face and skull are involved.

The oral surgeon electing to manage trauma to the middle third of the face, especially if the maxillae are grossly displaced or freely mobile, may be required to assume responsibility for providing an adequate diagnosis of the full extent of injury sustained. This does not mean that the oral surgeon will be making a comprehensive neurological examination in facial trauma of this nature. It means that if the oral surgeon is the responsible doctor, he must seek adequate neurological consultation in the event that injury warrants this investigation.

The adequacy of the architecture of the human skeleton has been noted to be remarkable from an engineering standpoint. It has been stated that the Notre Dame Cathedral in Paris is buttressed in a manner inspired by the buttressing bones of the middle face and orbit.

In a consideration of the maxilla as three-dimensional, it becomes apparent that this bone is rigidly buttressed to resist gross displacement. It further appears that any displacement of the maxilla is unlikely without considerable damage to several other bones. Cryer's[1] classical work has established these buttresses for the maxilla, and certainly, the zygoma and the pterygoid processes of the sphenoid bone provide the major shoring resistance against displacement (Fig. 1).

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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1. Cryer, M. H. Internal anatomy of the face, ed. 2. Philadelphia, Lea & Febiger, 1916.

The "egg-shell" bones such as the ethmoid and lacrimal bones seen in the walls of the orbit contribute only slightly to the bony support of the maxilla and are not considered major buttresses.

Although fractures of the zygoma are often observed along with fractures of the maxillae, there is a paucity of information in the literature concerning fractures of the more obscure pterygoid processes of the sphenoid bone (Fig. 2, left). With freely "floating" maxillae, it is difficult to visualize architecturally that no injury has been transmitted to the buttressing pterygoid plates. The dearth of such prior observations must be attributed to the difficulties encountered in making this diagnosis.

In directing attention to the pterygoid processes of the sphenoid bone, the vertical plates of the palatine bones will not be differentiated from the pterygoid processes, although they are in direct relation, nor will the horizontal plates of the palatine bones be considered apart from the palatine processes of the maxillae comprising the hard palate. These bones can be considered, for clinical purposes, as inseparable and as contributing slightly to the buttress effect.

In considering these fractures of the maxillae, it is assumed that the trauma responsible for the injuries was delivered from in front, or slightly to one side, of the patient. Forces delivered in this direction are predominantly responsible for

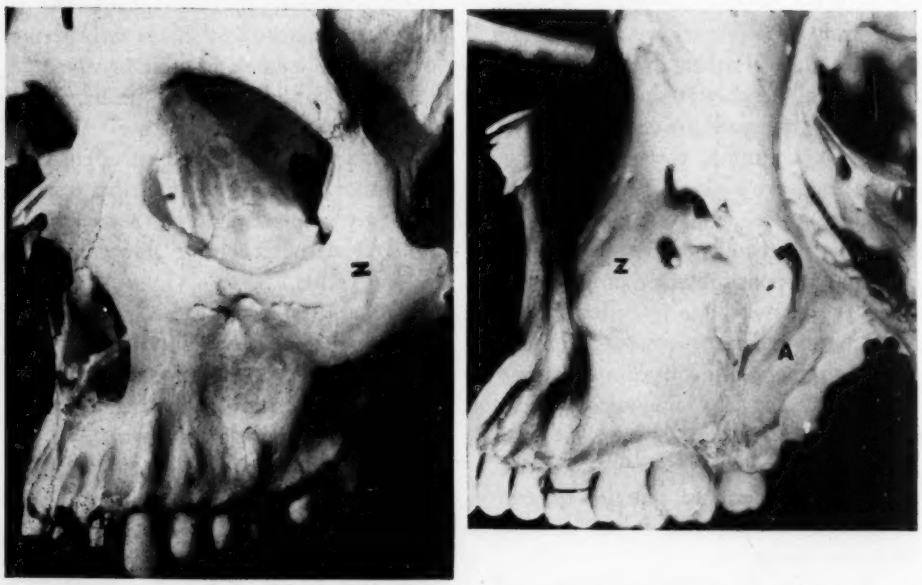

Fig. 1—Left: Zygoma (Z) forming one of the major buttresses for maxilla. Right: Lateral lamina of pterygoid process of sphenoid bone (A). Body of zygoma indicated at Z; zygomatic arch has been removed to facilitate viewing

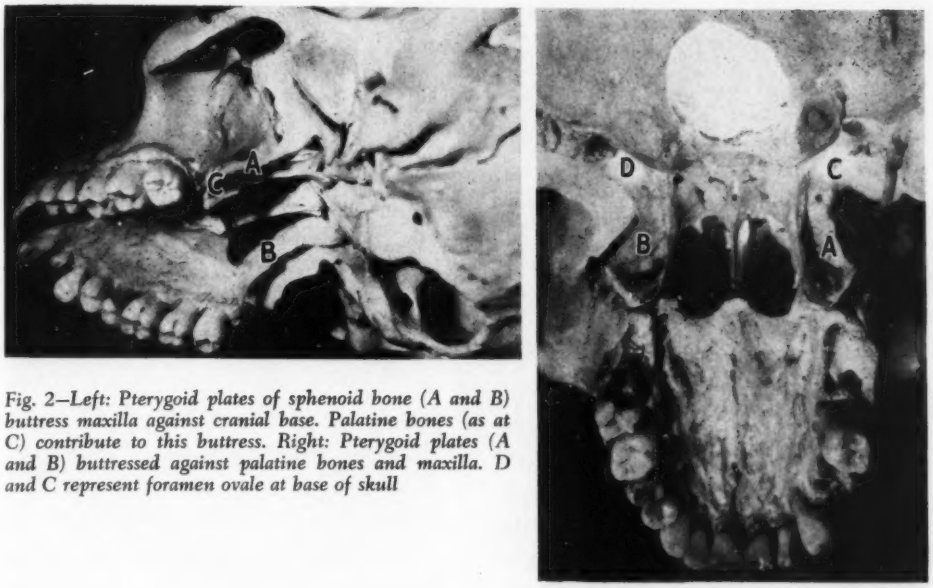

Fig. 2—Left: Pterygoid plates of sphenoid bone (A and B) buttress maxilla against cranial base. Palatine bones (as at C) contribute to this buttress. Right: Pterygoid plates (A and B) buttressed against palatine bones and maxilla. D and C represent foramen ovale at base of skull

the detachment of maxillae from their cranial bases.

Although the manner in which the entire maxilla is supported against the skull and the cranial base is complex, and the role of one of these major buttresses, the zygoma, is clearly observed, this article will confine itself to the other major buttress, the shoring pterygoid plates of the sphenoid bone. Numerous other bones, of course, contribute to the support of the maxillae, but in a relative sense, they are not major buttresses in the sense that the zygoma is butted against the frontal bones and the pterygoid plates are shored against the cranial base (Fig. 2, right).

Even in the simplest types of maxillary fractures resulting in mobility and displacement, it appears reasonable to suspect concomitant fracture of the pterygoid processes of the sphenoid bone. A considerable portion of the force required to fracture a maxilla is transmitted via the pterygoid plates to the base of the skull. It also appears likely that the force so transmitted could easily result in fracture of the pterygoids at the "foramina-weakened" base of the skull. Of course, fractures of the pterygoid plates could occur anywhere along the course of their bodies, but, in this latter instance, the injury would be relatively minor as compared to basilar skull fracture occasioned in the former instance. It is difficult to establish roentgenographically the full extent of basal skull fractures; generally, the end results of dural lacerations and other brain damage are best observed in clinical neurological examination.

It has been said that it is good judgment to suspect basal skull fracture in every displaced maxillary fracture until

proved otherwise. When it is established that the injury has caused neurological damage, or when this damage is suspected but obscured, early medication for aborting secondary infection, such as meningitis, is indicated. Other medication which might contribute to the clouding of objective symptoms or perhaps elevate intracranial pressures is contraindicated pending early and thorough examination for the full extent of the injury.

In instances of injury to the middle third of the face, the neurological examination commonly is concerned with the following:

1. The patient's state of consciousness. Any patient with an injury to the middle third of the face who is not under the influence of drugs but who demonstrates stupor, confusion, or other signs of mental lassitude, is considered as having a neurological problem. A brief period of unconsciousness might indicate nothing more serious than a brain concussion, but the patient who appears to remain in constant, deep sleep and is aroused with great difficulty (only to resume his fitful sleep immediately) is comatose as a result of cerebral damage.

2. Any inequality of reflexes of one side of the body as compared to the other side, as in hemiplegia or weakness of the skeletal musculature. This inequality is of great importance.

3. Increasing systolic pressure in the absence of disturbances such as gross fractures and full bladder. This increase in pressure is a disturbing sign.

4. A test for the Babinski sign, or great toe reflex. In this examination, the patient's leg is slightly flexed at the knee, and the lateral aspect of the sole of the foot is stroked from heel to toe by any instrument producing a noxious stimulus. The reaction to this irritation is carefully observed. An extension of the great toe, with or without "fanlike" separation of the remaining toes, is determined as a positive Babinski response. The great toe reflex is considered as indicative of pyramidal tract dysfunction and in head injury is suggestive of temporal lobe herniation and midbrain compression; therefore, it is viewed with grave concern.

5. Possible cerebrospinal rhinorrhea or otorrhea; antibiotic treatment should be instituted or intensified accordingly.

6. Ophthalmological considerations. Inequality of the pupils, particularly when one pupil demonstrates progressive and fixed dilatation, is a strong indication of temporal lobe shift. Bilateral fixation of the pupils, with dilatation or constriction, indicates a grave prognosis. A choked optic disk may indicate increased intracranial pressure such as that brought about in cerebral hemorrhage, contusions or lacerations.

7. Battle's sign—ecchymosis about the mastoid and along the course of the posterior auricular artery, remote from the site of direct trauma—is indicative of possible basal skull fracture. This may also be true of periorbital ecchymosis. In Figure 3 is shown a patient who had struck the anterior portion of his face against the steering wheel of his car in an accident. Fracture of the nasal bones and of the right side of the body of the mandible was immediately discernible. There was no history of unconsciousness. More

Fig. 3—Left: Patient with fracture of nasal bones and right side of body of mandible. Right: Battle's sign (ecchymosis about mastoid and along course of posterior auricular artery remote from site of direct trauma). Patient has basal skull fracture

thorough examination disclosed ecchymosis about the mastoid and along the course of the posterior auricular artery, remote from the site of direct trauma. Complete examination disclosed basal skull fracture.

These preliminary neurological observations are not intended to constitute a thorough neurological examination, nor are they recommended in lieu of a more adequate examination by qualified personnel; instead they should be utilized to guide the oral surgeon in requesting neurological consultation.

All detached maxillae, fortunately, are not accompanied by brain injury. In many instances, however, they are associated with skull fracture, and most (but not all) skull fractures result in some cerebral injury. A simple fracture may cause severe damage, or a severe fracture may result in only mild brain injury. Although some of these cases require the care of the neurosurgeon in repairing lacerated dura, in evacuating hematomas, in arresting hemorrhage and in débriding bone spicules, many patients recover from contusions and subarachnoid hemorrhage, and some recover from subdural hematomas without ever clearly demonstrating obvious clinical signs of neuropathologic disturbance or a clearly defined roentgenographic picture of skull fracture. On the other hand, extradural hemorrhage from an injured artery requires immediate surgical intervention.

If any one postinjury period can be

considered more critical than another, perhaps it is the first 24 hours after injury. Latent reactions such as may be evident in postinjury aneurysms, however, can be slow in becoming demonstrable. Certainly, the cavernous sinus is vulnerable in injuries at the base of the pterygoid plates of the sphenoid bone to either early or latent responses. A pulsating exophthalmus suggests injury involving the cavernous sinus.

Although it may be true that the oral surgeon's procedure in managing displaced maxillae concomitant with basal skull fracture or fracture along the course of the pterygoid processes will not vary in regard to technic for reduction and immobilization, it nevertheless remains true that such concurrent and associated injury should not be overlooked. The fact that the maxillae are so buttressed by the pterygoid plates of the sphenoid bone as to make displacement unlikely unless the pterygoid processes (somewhere along their course or at their attachment to the cranial base) are concomitantly fractured and displaced may be only of academic importance. If this heretofore rarely publicized and perhaps rarely recognized associated injury is considerably more frequent than can be established from the current literature, then it becomes expedient for the oral surgeon to be alert for symptoms that may indicate more obscure, but no less serious, injury. Adequate consultation to rule out intracranial damage is an early diagnostic procedure of choice in maxillofacial fractures of this nature.

■ *Summary*

1. The oral surgeon electing to treat injury of the middle third of the face, if he is the responsible doctor, may be obligated to provide the means for determining the full extent of head injury.

2. Freely "floating" maxillae seldom are solitary clinical entities. Other injuries involving buttressing bones, such as the zygoma and the pterygoid plates of the sphenoid bone, generally are involved. These complications may result in obvious or obscure cranial injury.

3. Particular attention is focused on the probability of fractures along the body of the pterygoid processes of the sphenoid bone and along the "foramina-weakened" base of the skull.

4. Diagnosis of fracture of the pterygoid plates is difficult, even with the best roentgenographic technic, and a neurological examination for clinical evidence of neuropathologic disturbance may be necessary.

5. In the event of neurological damage, the oral surgeon's management of maxillary fracture (in regard to surgical technic) will not be materially affected except as it involves the optimum time for providing this treatment.

6. Some general rules concerning neurological signs indicating serious prognosis in patients with displaced maxillae are recorded.

7. The points presented in this article are intended to be primarily of academic interest.

Review of surgical procedures for correction of mandibular prognathism

■ *Edward C. Thompson, D.D.S., and Emmett H. Jurgens,* D.D.S., Urbana, Ill.*

Deformities of the mandible which are seen by the oral surgeon include mandibular protrusion (prognathism), mandibular retrusion, open bite and facial asymmetry associated with these anomalies. Mandibular prognathism, with or without an open bite, is by far the most common condition encountered.[1]

Mandibular prognathism is usually considered to be an idiopathic condition due to heredity factors. However, there are secondary causes for mandibular prognathism. The etiology of secondary mandibular prognathism follows.

■ *Hereditary and Congenital Malformations*

Persons with cleft palates possess an underdeveloped maxilla which may create an apparent mandibular prognathism. The mandible, in this instance, is of normal size but the maxilla lacks normal development. Macroglossia due to hemangioma or lymphangioma may mechanically influence the growing mandible, causing its enlargement. Achondroplasia (fetal chondrodystrophia) is a hereditary growth disturbance of the cartilaginous parts of the bones and involves a shortening of the cranial base, receding maxilla and a relative mandibular prognathism. Cleidocranial dysostosis affects the development of the maxilla, causing relative mandibular prognathism. Oxycephaly (due to craniostosis) involves a micrognathic maxilla with relative mandibular prognathism due to the premature closure of the cranial sutures. Leontiasis occasionally can give rise to a widened, enlarged mandible with protrusion due to a diffuse hyperostoses caused by periosteal proliferation and sclerosis of the bones. Osteopetrosis (marble bones) has been observed in association with mandibular prognathism.

■ *Endocrinopathy*

Acromegaly is in most instances attended by mandibular prognathism. Eunuchoid gigantism (hypogonadism) in some instances assumes an acromegalic character with mandibular protrusion. In cretinism, mandibular prognathism has been considered to be secondary to the lingual enlargement.

■ *Posttraumatic Forms*

Fractures of the mandible, usually bilateral, may heal so that the mandible is in a protruded position. Also, fractures of the maxilla may result in maxillary re-

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1. Surgical treatment of jaw deformities. Editorial. Oral Surg., Oral Med. & Oral Path. 4:677 June 1951.

trusion, and relative mandibular protrusion may result. Scar tissue contracture of the chin and neck, usually after burns at an early age, has been reported to cause traction and elongation of the mandible forward and downward so that the mandible becomes prognathic.

■ *Postinfectious Forms*

Mandibular infection, particularly osteomyelitis, has been followed by a hyperplastic reaction with resultant mandibular prognathism.[2] Tonsillitis and adenoiditis, followed by hypertrophy of these structures, may cause a child to protrude the mandible to afford relief in breathing. The flat plane of deciduous dentition makes it possible to reposition the mandible anteriorly. The relative softness of deciduous enamel permits rapid wear, and in a short time a new position may be created for the mandible.[3]

■ *Surgical Correction*

There are two primary reasons for surgical correction of mandibular prognathism. One is the correction or improvement of mastication of food; the other is the improvement of the profile. If the deformity can be corrected by orthodontic treatment, surgical intervention is contraindicated.

The preoperative examination should include a general physical examination and thorough oral examination by the oral surgeon and the orthodontist. The need for preoperative orthodontic treatment should be determined. Study models must be made and mounted on an articulator with the mandible in its postoperative position. If there are any interfering cusps, they should be eliminated by preoperative selective grinding.[4] Orthodontic appliances for intermaxillary fixation should be applied preoperatively even though transosseous wiring or plating is used. If splints are utilized, they should be constructed and applied before the operation.[5]

In 1849, Hullihen successfully performed an intraoral operation for the correction of prognathism.[6] Blair performed a similar operation almost 50 years later. Several other operations which have been developed since then, correct the deformity by repositioning the teeth after a mandibular ostectomy or osteotomy. The operations recommended may be classified according to their anatomic location, namely, the ascending ramus, the body of the mandible or the neck of the condyloid process. Naturally there are variations in the technic of each. Some oral surgeons elect the extraoral approach, others prefer the intraoral method and still others a combination of the two performed either simultaneously or as two separate procedures.

■ *Osteotomy of the Ascending Ramus*

CLOSED METHOD—In 1898 Blair performed the first reported osteotomy of the mandible by the closed method.[7] A small incision 2 cm. long is made along the posterior border of the ramus. The skin

2. Hogeman, Karl-Erik. Surgical orthopaedic correction of mandibular protrusion. Acta chirurg. Scandinav. Supplementum 159. Stockholm, Sweden, 1951, p. 23-25.

3. Gold, J. K. New approach to the treatment of mandibular prognathism. Am. J. Orthodont. 35:893 Dec. 1949.

4. Waldron, C. W.; Peterson, R. G., and Waldron, C. A. Surgical treatment of mandibular prognathism. J. Oral Surg. 4:61 Jan. 1946.

5. Thoma, K. H. Oral surgery, vol. 2. St. Louis, C. V. Mosby Co., 1952, p. 1487.

6. Anderson, C. F.; Wash, A. M., and Smith, LeRoy. Correction of prognathism. J. Oral Surg. 11:118 April 1953.

7. Pearson, W. H. Resection of the mandible. Am. J. Orthodont. & Oral Surg. 29:141 March 1943.

only is divided, and the parotid sheath is opened at the anterior border of the gland and pushed back to expose the posterior border of the ramus. A large, blunt, curved ligature carrier is inserted and advanced along the inner surface of the ramus at a level above the mandibular foramen. When the anterior margin of the ramus is reached, the skin is elevated and another incision is made. A Gigli wire saw is then drawn back through the first incision (Fig. 1, above). The ramus is then cut through without causing injury to the mandibular nerve and vessels. After sectioning of both rami, the mandible is placed in its proper relation to the maxilla (Fig. 1, below), and intermaxillary traction is applied.[8-11]

Fig. 1—Above: Gigli wire saw inserted to perform osteotomy of ramus by closed method. Below: Preoperative prognathic position of mandible and postoperative repositioning after osteotomy

INTRAORAL METHOD—There have been two methods described for an intraoral approach and subsequent osteotomy of the rami. In both methods an incision is made intraorally down the anterior border of the ramus, and the periosteum is reflected until the lingual nerve and structures entering the mandibular foramen are identified.

Moose[12] then inserts a specially designed instrument to retract the soft tissues medial to the ramus (Fig. 2, left). A power-driven, short-stroke, crosscut orthopedic saw (known as the Cayo saw) is then inserted to resect the ramus (Fig. 2, right). Injury to adjacent soft tissues is remote; for as soon as the bony parts are resected, the firm contact of the saw against the ramus is no longer possible and the soft tissues in contact with the saw move with the saw because of its fast, short stroke.

Sloan[13] describes a clamp which is secured to the ramus to permit the use of a narrow-bladed handsaw (Fig. 3). After the proper incision and elevation of the soft tissues from the medial surface of the mandible, the bone clamp is inserted. A hook at the distal end of the clamp engages the posterior border of the ramus. The clamp's adjustable jaw is then secured to a small notch previously cut in the anterior border of the ramus. A specially designed handsaw is then inserted in the space

8. Thoma, K. H. Oral surgery, vol. 2. St. Louis, C. V. Mosby Co., 1952, p. 1489.

9. Weiss, B.; Lentz, M. J., and Newman, J. Correction of severe mandibular protrusion by osteotomy of the rami and orthodontics. Am. J. Orthodont. & Oral Surg. 27:1 Jan. 1941.

10. Traynham, W. H., Jr. Bilateral osteotomy of the rami for marked protrusion of the lower jaw: report of a case. J.A.D.A. 31:1025 Aug. 1944.

11. Adelstein, C. S. Orthodontic and surgical correction of a Class III malocclusion. Report of a case. Am. J. Orthodont. 38:704 Sept. 1952.

12. Moose, S. M. Correction of abnormal mandibular protrusion by intraoral operation. J. Oral Surg. 3:304 Oct. 1945.

13. Sloan, A. C. Intraoral osteotomy of ascending rami for correction of prognathism. Texas D. J. 69:375 Sept. 1951.

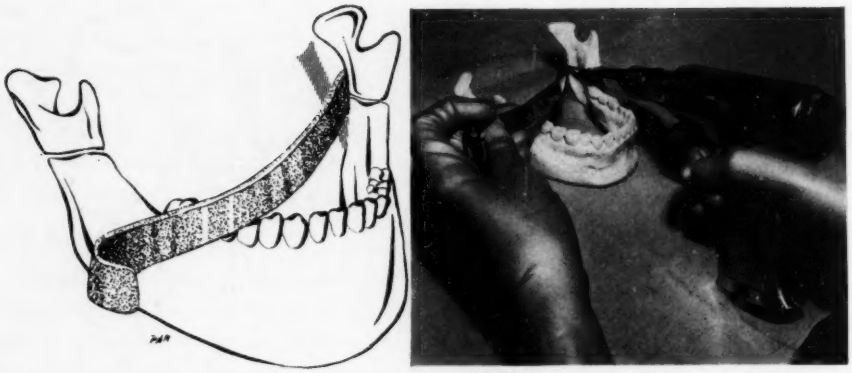

Fig. 2—Intraoral method of osteotomy. Left: Specially designed instrument in place to retract vital soft tissues. Right: Retractor and Cayo saw in place on model of mandible. (Illustration after Moose)

provided for it in the clamp, and the ramus is resected. Sloan also advocates interosseous wiring to supplement intermaxillary fixation. From a hole drilled in the external oblique ridge of the inferior section a stainless steel wire is passed over the mandibular notch with an aneurysm needle and tightened. The passing of the wire over the mandibular notch with an aneurysm needle has proved difficult to accomplish in the authors' hands; however, stability was achieved by boring a hole in each fragment with the hole in the superior fragment cut posteriorly the distance equal to the amount of correction required and by ligating the two fragments together. The wires are not fully tightened until the mandible is repositioned.

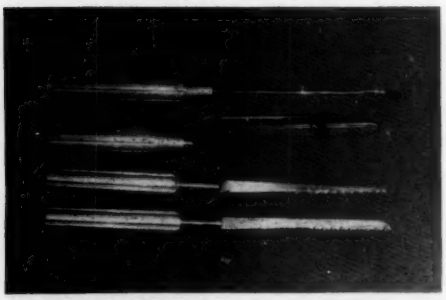

Fig. 3—Apparatus for intraoral osteotomy. (Illustration after Sloan)

EXTRAORAL METHOD — Kazanjian[14] and others[4, 15, 16] have been proponents of the extraoral approach to osteotomy of the rami. A curved incision about 1 inch long is made below and behind the angle of the mandible. The masseter muscle is exposed and cut through, and the anterior surface of the mandible is brought into view. The ramus is then sectioned transversely with a sharp osteotome, cutting the bone on a bevel. Beveling in this fashion allows for a greater area of contact of the cut ends,

14. Kazanjian, V. H. Treatment of mandibular prognathism with special reference to edentulous patients. Oral Surg., Oral Med. & Oral Path. 4:680 June 1951.

15. Lloyd, R. S. Osteotomy for the correction of mandibular protrusion. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 32:445 July 1946.

16. Smith, A. E., and Johnson, J. B. Surgical treatment of mandibular deformations. J.A.D.A. 27:689 May 1940.

(Fig. 4) promoting an early union in the new position. Caldwell[17] has recently advocated a vertical osteotomy of the mandibular rami, using an extraoral approach. The technic is complex. Early return to function is claimed as an advantage; therefore, it might prove useful for an occasional case, but doubtless simpler methods are preferable.

COMBINATION METHOD – Skaloud[18] advocates the use of a combination intraoral-extraoral method for osteotomy of the rami. As in the previously described intraoral methods, a vertical incision is made along the anterior margin of the ramus, and the soft tissues medial to the ramus are retracted (Fig. 5, above left). A straight ligature needle is then inserted intraorally and passed posteriorly until it reaches the skin behind the lobule of the ear (Fig. 5, above center). After the needle is pushed through the skin, a Gigli wire saw is attached and the needle drawn back into the oral cavity (Fig. 5, above right). The ramus is sectioned with the Gigli wire saw, while the lip is protected by a cheek retractor (Fig. 5, below left). A hole is then drilled in the inferior fragment. By means of a Reverdin needle an interosseous wire ligature is passed over the mandibular notch, through the hole in the inferior fragment, and tightened (Fig. 5, below right). The intraoral wound is then closed by suturing, and intermaxillary traction is applied.

■ *Ostectomy of Body of Mandible*

INTRAORAL METHOD—The intraoral method for ostectomy of the body of the mandible has the advantage of simplicity. Another advantage is that during the entire operation the occlusal result may be

17. Caldwell, J. B., and Letterman, G. S. Vertical osteotomy in the mandibular rami for correction of prognathism. J. Oral Surg. 12:185 July 1954.

18. Skaloud, Francis. New surgical method for correction of prognathism of the mandible. Oral Surg., Oral Med. & Oral Path. 4:689 June 1951.

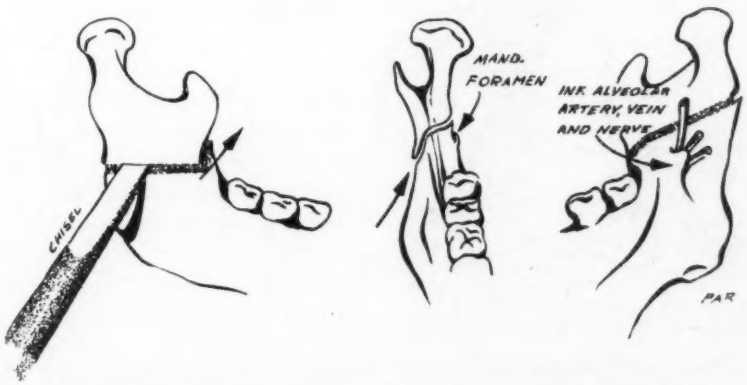

Fig. 4—Method of extraoral osteotomy. Left: Lateral view showing positioning of osteotome to cut an oblique section. Center: Anteroposterior view showing oblique sectioning. Right: Medial view showing margin of safety from inferior alveolar nerve and vessels. (Illustration after Kazanjian)

observed. If teeth are to be sacrificed, their removal may be executed either preoperatively or at the time the operation is performed.

A longitudinal incision is first made along the crest of the alveolus at the site of the ostectomy. This incision is joined by two transverse incisions which are made in the buccal mucoperiosteum at the mesial and distal extremities of the edentulous space and extend from the crest of the alveolus to the inferior border of the mandible (Fig. 6, left). The mental nerve must be avoided. The mucoperiosteum is then detached from the bone. Usually a metal pattern is made before the operation to indicate the exact width of the bone section to be removed. The ostectomy is performed using bone drills and a thin-bladed osteotome (Fig. 6, right). The procedure is repeated on the other side, the fragments are placed in

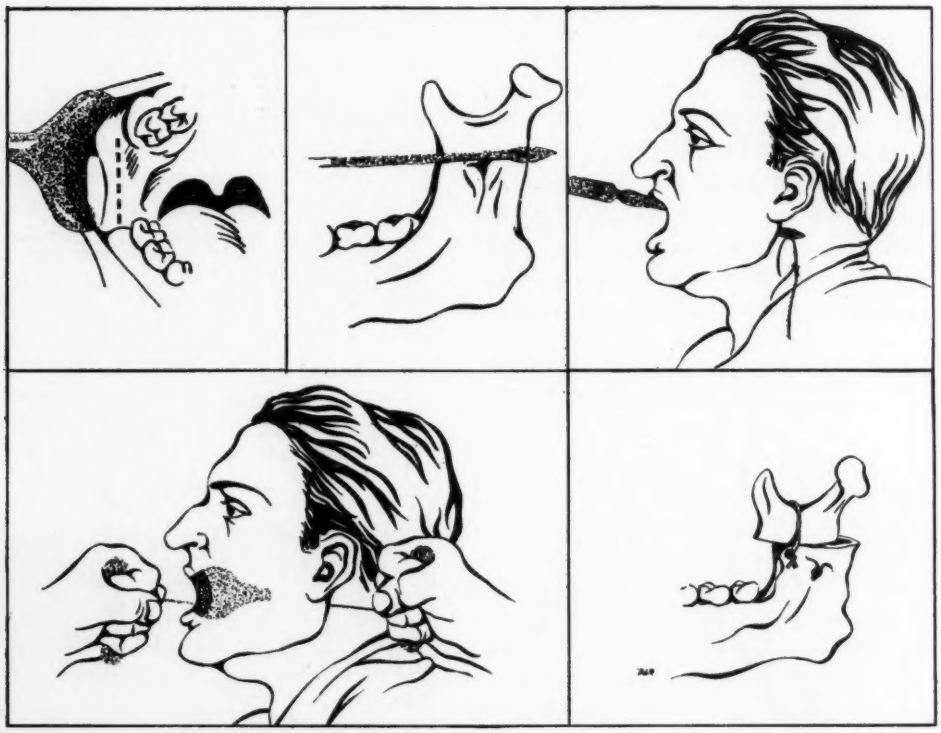

Fig. 5—Combination method of intraoral-extraoral osteotomy. Above left: Dotted line shows site of intraoral incision. Above center: Ligature needle in place on medial surface of mandible. Above right: Extraoral view showing attachment of Gigli wire saw to ligature needle. Below left: Sectioning of ramus with Gigli wire saw. Note protection of lips and cheeks by cheek retractor. Below right: Interosseous wire ligature placed over mandibular notch from suitably placed hole in inferior fragment. (Illustration after Skaloud)

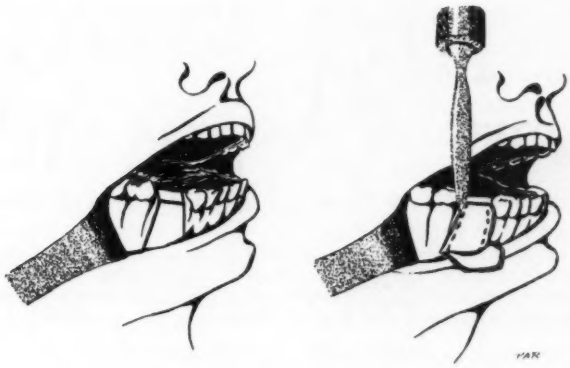

Fig. 6—Intraoral method for performing ostectomy of body of mandible. Left: Incision lines. Right: Osteotomy performed with osteotome. (Illustration after Thoma)

their proper relationship and intermaxillary fixation is applied.[19]

An obvious disadvantage of this method is that the contents of the mandibular canal are sectioned. This sectioning may cause a rather severe hemorrhage and will inevitably produce anesthesia of the lower anterior teeth and lower lip for a period extending from several weeks to a year or longer or until the mandibular nerve regenerates.

EXTRAORAL METHOD—New and Erich[20] describe an extraoral method for mandibular ostectomy. A skin incision is made below the inferior border of the mandible. Subcutaneous tissues and the platysma muscle are divided, and the periosteum is incised and elevated to the alveolar border. With bone drills and a saw, two cuts, previously measured, are made from the inferior border of the mandible to the level of the mandibular canal. A chisel is used to remove the intervening bone. The contents of the mandibular canal are preserved by scooping out a cavity in the cancellous bone immediately surrounding the mandibular canal to prevent impingement of the nerve and vessels when the anterior fragment is repositioned.

COMBINATION METHOD—The combination intraoral-extraoral procedure may be executed either in one stage as described by Thoma[21] or in two stages as first advocated by Dingman[22-24] and others.[25, 26] The two-stage method seems to be the procedure of choice.

19. Thoma, K. H. Oral surgery, vol. 2. St. Louis, C. V. Mosby Co., 1952, p. 1495-1497.

20. New, G. B., and Erich, J. B. Surgical correction of mandibular prognathism. Am. J. Surg. 53:2 July 1941.

21. Thoma, K. H. Oral surgery, vol. 2. St. Louis, C. V. Mosby Co., 1952, p. 1499.

22. Dingman, R. O. Surgical correction of mandibular prognathism, an improved method. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 30:683 Nov. 1944.

23. Dingman, R. O. Surgical correction of developmental deformities of the mandible. Plast. & Reconstruct. Surg. 3:124 March 1948.

24. Van Alstine, R. S., and Dingman, R. O. Correction of mandibular protrusion in the edentulous patient. J. Oral Surg. 11:273 Oct. 1953.

25. Thompson, E. C.; Burch, R. J., and Berkson, R. Bilateral mandibular ostectomy for correction of congenital prognathism. Illinois D. J. 19:277 July 1950.

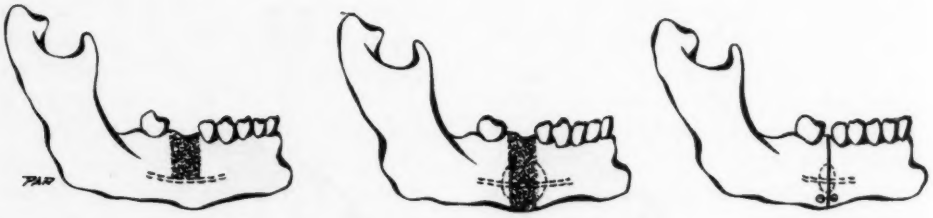

Fig. 7—Two-stage method of performing ostectomy of body of mandible. Left: First stage. Intraoral cuts made to mandibular canal. Center: Second stage. Extraoral cuts showing hollowing out of medullary bone to accommodate excess contents of mandibular canal after repositioning of fragments. Right: Repositioned fragments with interosseous wire in place. (Illustration after Dingman)

The teeth to be sacrificed are removed unless the region is edentulous. Intraorally, the buccal and lingual mucoperiosteum in the immediate vicinity is elevated from the mandible. With a bone drill, two incisions are made downward across the alveolar ridge, maintaining a safe distance between the depth of the bone incision and the mandibular nerve. No bone is removed at this time. The soft tissues are approximated and sutured. During a four to six week healing interval, suitable orthodontic appliances are fabricated to facilitate intermaxillary fixation and maintenance of the fragments after sectioning. The second stage of the operation is then carried out (Fig. 7 and 8).

An incision is made 1 cm. below and parallel to the inferior border of the mandible. After exposure of the inferior border of the mandible, the periosteum is elevated until the intraoral cuts are exposed. These cuts are then extended through the cortical bone plate downward and through the inferior border of the mandible. A horizontal cut is also made through the cortical plate on the buccal surface about 1 cm. above the inferior border and between the two vertical cuts. A small chisel is inserted into the cut, and with a twisting motion, the lower portion of the section is fractured to expose the mandibular nerve and vessels. The block of bone above the nerve is then dissected out. After this has been accomplished, the medullary portion of the bone adjacent to the nerve is hollowed out to permit a resting place for the excess nerve when the fragments are approximated. Interosseous wire is placed between the two fragments but is not tightened until the opposite side is sectioned. The incision is closed, and intermaxillary fixation is applied.

Intermaxillary fixation after either an ostectomy or osteotomy is difficult if the patient is edentulous. Plating,[26] an acrylic splint with circumferential wiring, and interosseous wires have been recommended.[24] An Australian group has advocated the use of Kirschner wires to supplant intermaxillary fixation even in persons having a natural dentition.[27] The use of Kirschner wires for these persons

26. Cameron, J. R., and Stetzer, J. J., Jr. Bilateral resection of the mandible to correct prognathism. J. Oral Surg. 6:69 Jan. 1948.

27. Scougall, S., and Colvin, G. Functional retention in pre-angular resection for malocclusion in protrusion of the mandible. Oral Surg., Oral Med. & Oral Path. 4:695 June 1951.

appears awkward and is seldom used by those surgeons who have had dental training.

■ *Osteotomy in Neck of Condyloid Process*

An osteotomy of the neck of the condyloid process is a relatively simple procedure. An incision about 1 cm. in length is made through the skin at the posterior border of the ramus about midway between the angle of the mandible and the lobe of the ear. Dissection is carried down to the posterior surface of the ramus. A full-curved aneurysm needle is inserted through this incision and, keeping in contact with the medial surface of the ramus, the needle is rotated until it passes through the sigmoid notch and elevates the skin. Here another skin incision is made to permit emergence of the aneurysm needle. A Gigli wire saw is fastened to the needle and drawn through the incisions. The soft tissues are protected by retraction, and the neck of the condyloid process is divided (Fig. 9, left). The skin is sutured, and the procedure is repeated for the opposite side. After the mandible is repositioned (Fig. 9, right), intermaxillary fixation is applied.[28]

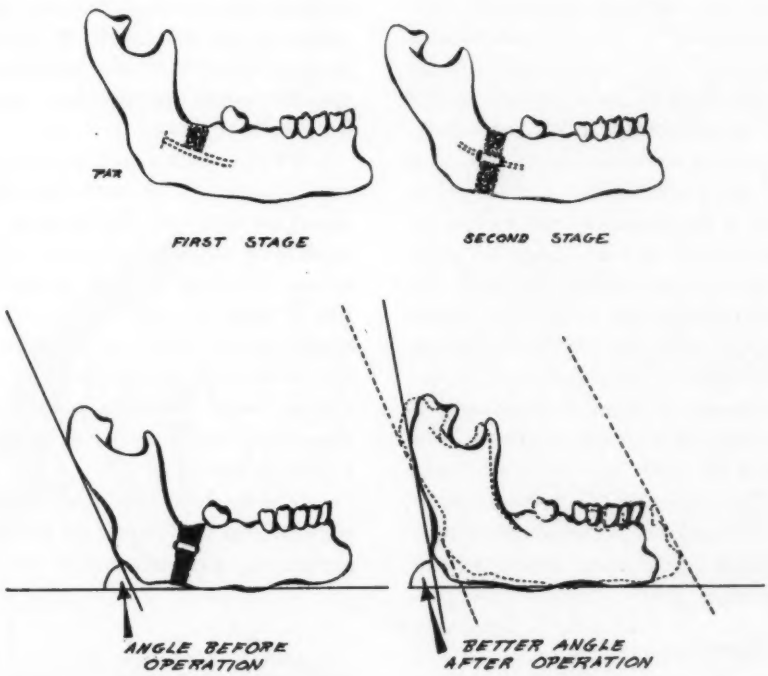

Fig. 8—Above: Site of ostectomy in molar region of body of mandible. Below: Better angle possible after repositioning of fragments. (Illustration after Anderson, Wash and Smith)

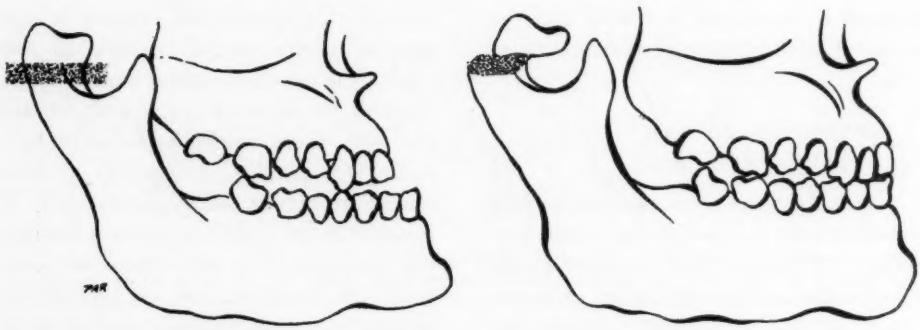

Fig. 9—Left: Area of sectioning neck of condyloid process for osteotomy. Right: Mandible repositioned after osteotomy in neck of condyloid process. (Illustration after Reiter)

"BOW-BACK" OPERATION TO ESTABLISH PSEUDOARTHROSIS—The "bow-back" operation was originally reported by Pettit and Walrath[29,30] for the correction of ankylosis of the temporomandibular joint. The same effect is created as if a bilateral condylectomy were performed.

The neck of the condyloid process is exposed and is severed with a chisel below the head of the condyloid process but inside the capsular ligament (Fig. 10, left). The establishment of the false joint depends on the insertion of a piece of temporal fascia into the artificial fracture (Fig. 10, right). The flap of fascia, after being loosened, is turned down and is fastened with two lateral sutures to hold it between the loose ends. A bony union is thus impossible and felt to be unnecessary by the authors. The pseudoarthrosis thus created functions as a universal or "flail" joint.

■ *Summary*

A number of operations have been devised and recommended for the correction of mandibular prognathism. Some of these operations have become almost standard procedures. When several procedures have been developed, it is generally a sign that none are quite satisfactory, that there are advantages and possible complications that may arise from each of them.

Of the several technics for performing osteotomy of the ascending ramus, the closed method and the extraoral method seem to be the most hazardous. The most serious objection to these technics is the risk of injury to the facial nerve. Other complications which may arise are damage to the internal maxillary or temporal arteries with resultant profuse hemorrhage and the possibility of formation of a parotid fistula.

The intraoral and combination intraoral-extraoral approaches are excellent for performing an osteotomy of the ramus,

28. Reiter, E. R. Mandibular prognathism. Case report presented to the American Board of Oarl Surgery.

29. Pettit, J. A., and Walrath, C. H. "Bow-back" operation for the relief of prognathism. Am. J. Orthodont. & Oral Surg. (Oral Surg. Sect.) 33:773 Nov. 1947.

30. Pettit, J. A. Surgical correction of prognathism. J.A.D.A. & D. Cosmos 24:1837 Nov. 1937.

especially since antibiotic therapy will adequately control contamination of the wound. The two intraoral technics mentioned have one serious disadvantage; the cortical bone on the posterior border of the mandible is very difficult to sever as only a few teeth of the saws used can be applied. The combination intraoral-extraoral technic (of Skaloud) seems the best for osteotomy of the ramus. All the soft tissues just medial to the ramus are retracted to avoid trauma and risk of injury to these structures. The chance of formation of a parotid fistula is almost nil. Using the combination intraoral-extraoral technic has reduced the required operating time considerably.

One of the greatest objections to osteotomy of the ramus is the adjustment which must be made by the muscles of mastication and the temporomandibular joints after the mandible has been removed posteriorly. In the only published long-range follow-up of a large number of patients (170), Hogeman[31] reported that all the patients adjusted to the new position satisfactorily. The function of the temporomandibular joints was impaired only to the extent that there was a mean decrease in the width to which the mouth could open of about 4 mm.

The possibility of postoperative open bite is eliminated by interosseous wiring.

The procedure for performing ostectomy of the body of the mandible has been highly refined by Dingman. With any of the described technics the danger of severance of the inferior alveolar nerve

31. Hogeman, Karl-Erik. Surgical-orthopaedic correction of mandibular protrusion. Acta chirurg. Scandinav. Supplementum 159. Stockholm, Sweden, 1951, p. 43, 127.

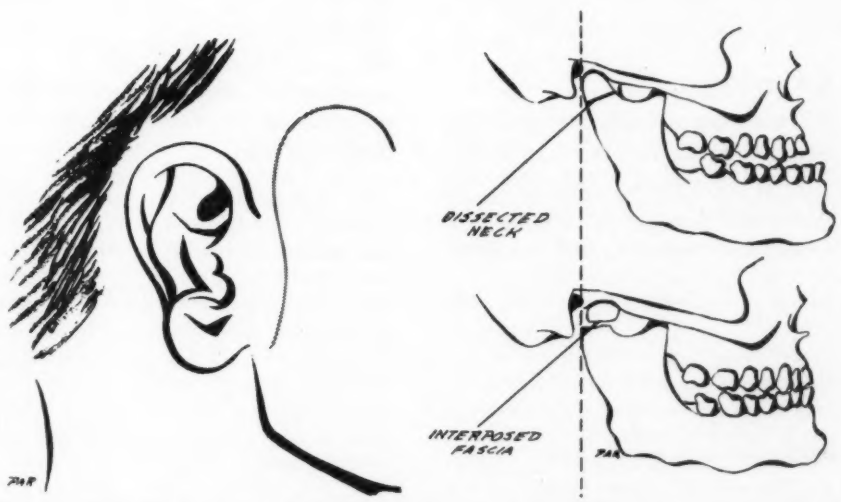

Fig. 10—Left: Incision for exposing neck of condyloid process. Right: Area of insertion of temporal fascia. (Illustration after Pettit and Walrath)

is ever-present. Although it is routinely reported that even though the nerve is severed it will regenerate, this regeneration cannot be assumed. Usually the sacrifice of teeth is necessary. The greatest advantages gained with this technic are (1) the elimination of possibility of an open bite and (2) control of the fragments, which is not as difficult as in osteotomy of the ascending ramus.

Osteotomy at the base of the condyle must be considered in a favorable manner because of the excellent results obtained by Reiter[32] over the past 12 years. In a series of more than 75 patients, only six transient complications occurred; these consisted of an involvement of some terminal branches of the seventh nerve. In all instances complete recovery of function returned in less than four months.

The "bow-back" operation to establish a pseudoarthrosis is a modification of osteotomy in the base of the condyle. Although good results have been reported, it seems an unnecessary procedure.

■ *Conclusions*

The technics and results achieved in the surgical correction of mandibular prognathism have been satisfactorily reported. Only the results of osteotomy of the ramus have been subjected to a thorough clinical and subjective follow-up examination of a significant number of patients.[32] The re-examination of the results of all methods over a period of years has, on the whole, been neglected. Such a re-evaluation is essential for the judgment of the clinical effect of a therapeutic method.

It would seem that the combination intraoral-extraoral technic (of Skaloud) for osteotomy of the ramus, with the application of an interosseous wire to stabilize the fragments, is the procedure of choice in surgical correction of mandibular prognathism. The procedure is neither extremely difficult nor time-consuming and danger of severance or trauma to adjacent nerves and blood vessels is minimal. Contamination of the wound by intraoral fluids is well controlled by sufficient antibiotic therapy.

The disadvantages of scars due to extraoral incisions in any of the described procedures should not be considered a prominent factor in the final esthetic result.

Surgical correction of mandibular prognathism by any method is a formidable procedure.

32. Reiter, E. Personal communication.

■ The Challenge of Science

The pursuit of science presents to the human mind an enduring challenge on an endless frontier, quite apart from the material enrichment of mankind to which it may incidentally give rise.—*Sir Edward Appleton.*

VOLUME 14 • APRIL 1956 • NUMBER 2

CASE REPORTS

Surgical reduction of multiple fractures in edentulous mandible: *report of case*

■ *Stephen P. Mallett, D.M.D., Boston*

A 35 year old white man appeared on February 23, 1950, because of a swelling overlying the left angle and right cuspid regions of the mandible. He reported he had sustained an injury while working on a dump truck. His jaw had become wedged between the frame and descending dump body. A "grating of jaw bone" soon had become evident and he "spit blood." He was taken to a local hospital, but within ten hours he had been transferred to our care at a hospital some 60 miles distant.

ROENTGENOGRAPHIC EXAMINATION—Lateral jaw roentgenograms revealed seven fracture lines; one single fracture extending from the center of the left sigmoid notch, 1.5 cm. downward through the middle of the ascending ramus, and then becoming a double fracture, then a single and double fracture again, to the lower border of the mandible at the angle. The lower fracture had an extension running superiorly and laterally to the distal border of the ascending ramus (Fig. 1, left). There was also a fracture in the lower left first molar region with an overriding of the distal segment in buccal position (Fig. 1, left). Two additional fractures were present in the right cuspid region (Fig. 1, right). There was considerable displacement of these fragments and, in addition, there was a triangular segment of bone with a 1 cm. base on the crest of the ridge (Fig. 2), and the apex directed toward the lower border of the mandible (Fig. 1).

GENERAL PHYSICAL FINDINGS—A physical examination was made at the time of admission to the hospital, but positive findings were limited to the mouth and jaw. No fresh bleeding was noted from the mouth, although there was evidence of ecchymosis of the jaw and neck. The jaws were edentulous. Mandibular action was limited, and there was clinical evidence of crepitus and point tenderness near each mental foramen. The ear canals and the nares were clear. There was no dyspnea or orthopnea. The patient otherwise was clinically normal and did not appear to be chronically ill.

TREATMENT AND COURSE—There was massive edema and infection present, so the patient could not be operated on until the condition had subsided. He was placed on a regimen of supportive and antibiotic therapy, using intramuscular injection of 100,000 units of aqueous penicillin every three hours.

The patient's temperature on admission was 100° F., but in three days it had receded to normal.

When the edema had almost disappeared, the fractures were reduced. Anesthesia was by intravenous thiopental sodium, maintained by nasoendotracheal nitrous oxide and oxygen and thiopental sodium. An incision was made below the left inferior border of the mandible from a point just distal to the angle and curving slightly forward to a point below the mental

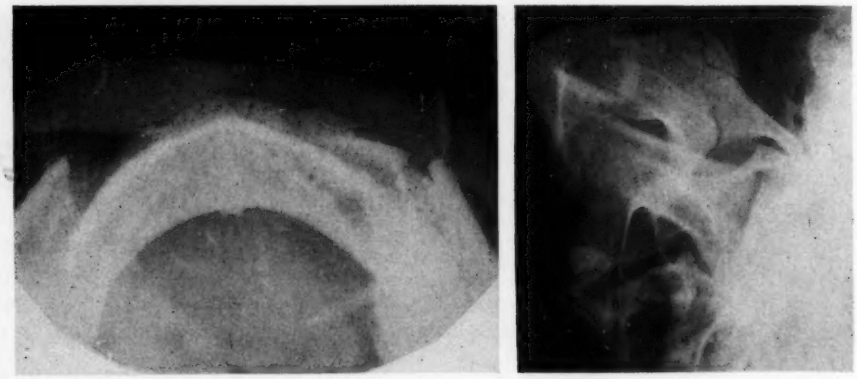

Fig. 1—Left: View showing single fracture extending from center of left sigmoid notch, 1.5 cm. downward through middle of ascending ramus, then becoming double fracture, then single and double fracture to lower border of mandible at angle. Lower fracture has extension running superiorly and laterally to distal border of ascending ramus. Fracture also in lower left first molar region with overriding of distal segment in buccal position. Right: Fractures in region of first molar on left side and of second cuspid region on right side

foramen. The small vessels were clamped and tied off. Dissection was extended through the platysma muscle exposing the external maxillary artery and vein. They were clamped and tied with chromic no. 00 sutures. The few remaining small vessels were tied. The fracture in the left molar region was found and dissected free, and four drill holes were made, two in each segment, 1.5 cm. apart. This was a diagonal fracture which extended from the left mesiolingual aspect to the distobuccal aspect of the mandible. Criss-cross wires approximated the segments, and the lingual wires were burnished against the lingual aspect of the mandible.

The floating angle section was found to be dissociated from the ascending ramus and the body of the mandible. Since it was small, it was removed and discarded. The fracture extending up into the ascending ramus toward the sigmoid notch was found to be complete. The drill holes were placed in the distal segment, and the fracture was reduced by horizontal placement of two wires (Fig. 3, left). The muscles were returned to their normal position with deep chromic sutures. The superficial structures were also closed with chromic catgut sutures, and the skin carefully approximated with dermal no. 00 sutures.

The fractures in the right cuspid region were reduced through an intraoral approach. An incision was made along the crest of the ridge extending from the lower right first molar region to the left cuspid region. At both ends of the wound the incision was extended inferiorly and diagonally distally, which permitted reflection of a buccal flap for access to the fracture sites. The incision was extended to the inferior border of the mandible. The lingual flap was also reflected downward for additional and adequate access. Subsequent dissection revealed a block of bone which was entirely separated and impossible to hold for drilling. It was removed and held between the fingers while the two holes were drilled into it. It was then wired into place (Fig. 3, right).

Because of the bone loss at the left angle, and in the right cuspid region, and also because of muscle pull, it was impossible to secure perfect apposition of the fractured segments, except in the left molar region. However, through the various bone wiring procedures and the additional slight external pressure of a Barton band-

age, the final result was excellent as can be seen in postoperative roentgenograms.

Except for the usual postsurgical traumatic edema and ecchymosis, the patient had a normal postoperative period, aided by penicillin therapy, cold compresses, bed rest and adequate fluid intake. On the third postoperative day, his temperature was normal and he was allowed to be out of bed. Every other extraoral suture was removed on the third postoperative day, and all extraoral and intraoral sutures were removed on the fifth postoperative day. The patient was discharged on the seventh postoperative day which was the fifteenth hospital day.

Eight weeks after injury, the intraoral wires in the mandibular cuspid region on the

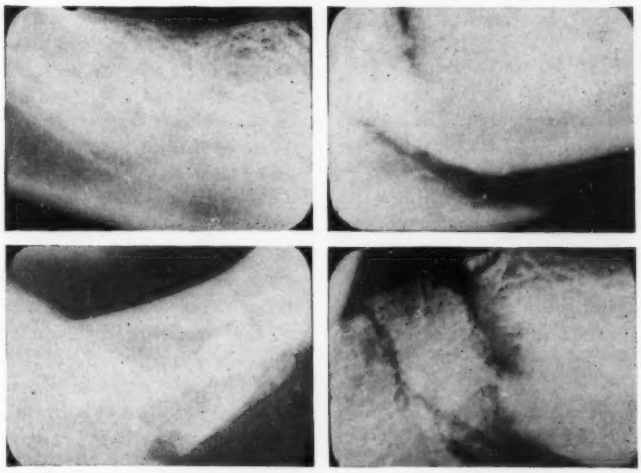

Fig. 2—Different angle views of two fracture lines in right cuspid region

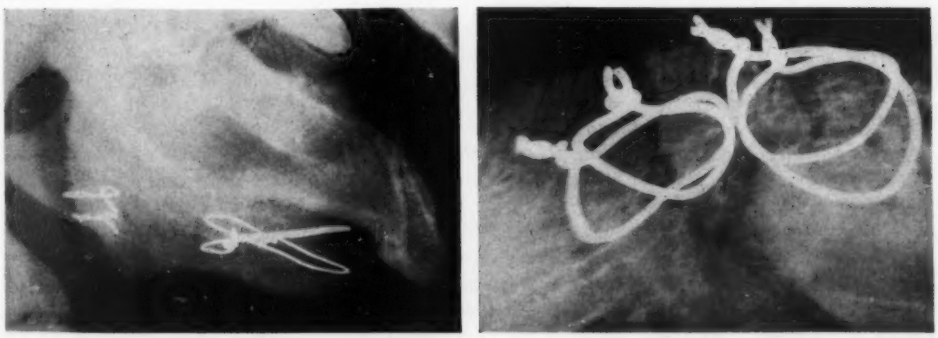

Fig. 3—Left: Overriding fracture in region of first molar reduced by criss-cross wires. Small angle fracture segment on left has been removed and two horizontal wires placed to reduce fracture of ascending ramus. Right: Fractures in cuspid region on right side reduced by four criss-cross wires

Fig. 4— View of scar two years postoperatively

right side were removed, but the extraoral wires in the second molar and ascending ramus region on the left side were left in place.

Clinical examination two years later showed a solidily healed mandible with good function. Roentgenographic examination verified this clinical impression. Cosmetically, the result was excellent (Fig. 4).

DISCUSSION—Fractures of edentulous mandibles present unusual complications since a good complement of teeth simplifies reduction problems. Unless the neck of the condyle is fractured and displaced causing a forward and lateral displacement of the mandible, external pin fixation or open reduction seems to be the preferred method of reduction in edentulous patients.

In such a case as is described here, an extraoral open reduction procedure is advisable in preference to skeletal fixation, because (1) open reduction provides a more positive reduction and fixation than does skeletal fixation, (2) the patient can be discharged to return to normal life earlier by open reduction, (3) the patient does not have to wear an uncomfortable appliance on his jaws and face, (4) the possibility of inadequate approximation of the fractured segments with pin fixation is eliminated by open reduction.

SUMMARY—The multiple mandibular fractures in an edentulous patient, which were complicated by lack of dentures, displacement of the fragments, infection and swelling, required extraoral open reduction at two fracture sites and intraoral reduction of two additional fractures. Good bony union was achieved.
—358 *Commonwealth Avenue.*

■ BIG DIVIDENDS FROM RESEARCH

In dollars and cents, how much does society get back for its investment in research and development? Raymond Ewell of the National Science Foundation recently examined this question. . . . Reasonable assumptions led to the estimate that in the United States the return averages from 100 to 200 per cent a year for 25 years. Over the course of 25 years, society gets back $2,500 to $5,000 for every $100 spent on research and development. Some of Ewell's figures are pretty speculative, but even if there is a large error in the estimated return, research and development appears, on a strictly financial basis, to be a first-class investment. Confirmation came from a chemical company and an oil company that had independently estimated their returns at 200 and 160 per cent per year, respectively. . . . A broker, apparently assuming we have money to invest, has recently been favoring us with persuasively written descriptions of the future prospects of a number of common stocks. Imagine the prospectus that could be written on the basis of Ewell's calculations if *Research and Development Unlimited* was listed on the New York Stock Exchange.—*Editorial, Science 122:581 Sept. 30, 1955.*

Circumscribed hysteric amnesia associated with oral surgery and general anesthesia: *discussion and report of case*

■ *Frank M. McCarthy, M.D., D.D.S., M.S.; Van M. Graves, D.D.S., and Adrian O. Hubbell, D.D.S., Long Beach, Calif.*

Amnesia associated with surgical procedures and general anesthesia is rare. Sadler[1] tells of a woman 50 years of age who underwent a bilateral mastectomy for suspected malignancy. Postoperatively there was an hysteric fugue lasting eight days. After emerging from the fugue, the patient had almost total amnesia regarding that period. A review of the literature reveals no other cases similar to the one reported herein.

Before considering the case proper, certain generalities will be reviewed concerning anxiety hysteria, hysteric amnesia, and migraine headache, all of which enter into an understanding of the case.

ANXIETY HYSTERIA—Anxiety hysteria is one of the most common neuroses. It is characterized almost entirely by anxiety symptoms. In contradistinction to conversion hysteria, where somatic symptoms predominate, anxiety hysteria may demonstrate transient simulated disorders; however, the emotion of anxiety itself is foremost.

According to English and Pearson,[2] "Every adult anxiety hysteria is a replica of a childhood experience." As examples, they state that childhood fear of the dark may arise from the inner tension of being separated from the mother, or that fear of animals may represent the punishing father. In the adult the thing feared is pushed even farther into the unconscious, and he becomes afraid of something outside himself. Basically the adult with anxiety hysteria fears an unknown which he is incapable of facing.

The prognosis is poor, particularly for those persons in whom the condition has existed for some time. These patients are distrustful, and it is difficult to give them insight into the original cause of their anxiety.[2] The usual psychotherapeutic measures of understanding, reassurance and suggestion are therefore not well tolerated. Psychoanalysis is the preferred treatment.

HYSTERIC AMNESIA — Hysteric amnesia ranges from simple absent-mindedness to serious memory lapses such as hysteric fugue and somnambulism.[1] When the individual experiences a temporary loss of memory and then recognizes that fact, he refuses to make any further attempt to remember. Bleuler[3] states that the essential factor with many of these persons is the exclusion of an unpleasant recollection from consciousness. Circumscribed amnesia may involve some isolated event which usually has had a strong affective meaning.[4]

MIGRAINE HEADACHE—It is known that migraine headache or syndrome is closely related to personality features such as inflexibility, conscientiousness, meticulousness, perfectionism and resentment.[5] These features lead to repeated frustration, resentment and anxiety. During the emotional states brought on by the foregoing, physiologic mechanisms set off the

1. Sadler, W. S. Modern psychiatry. St. Louis, C. V. Mosby Co., 1945.

2. English, O. S., and Pearson, G. H. J. Common neuroses of children and adults. New York, W. W. Norton & Co., Inc., 1937.

3. Bleuler, E. P. Textbook of psychiatry, ed. 2. New York, Dover Publications, Inc., 1951.

4. Henderson, D., and Gillespie, R. D. Textbook of psychiatry for students and practitioners, ed. 7. New York, Oxford University Press, 1950.

5. Cecil, R. L. A textbook of medicine. Philadelphia, W. B. Saunders Co., 1947.

attack of migraine which is recognized chiefly as the vasodilator type of headache.

REPORT OF CASE—A white woman, 54 years of age, came to our office on April 28, 1955, complaining of a moderately painful lower left second bicuspid. Duration of pain was two days. The routine preanesthetic history was essentially negative, except for the complaint of hypotension that had been present for the past five years. It had not been treated.

EXAMINATION—The patient was well developed, well nourished, and appeared to be in little distress. The tooth was carious to the pulp and was sensitive to percussion. A roentgenogram revealed periapical rarefaction. Blood pressure was 110/64; the pulse was regular and strong with a rate of 80.

MENTAL STATE—At the time of examination the surgeon noted incidentally that the patient was overbearing to the point of antagonism. She answered questions with reluctance and habitually asked that they be repeated. She seemed to resent the entire procedure and took up most of the examination by telling the surgeon repeatedly what she wanted done and how to do it.

TREATMENT—On the same day, under intravenous thiopental sodium anesthesia, the tooth was extracted. The extraction was without incident and the anesthesia was without complication. Thiopental sodium (12 cc. of 2.5 per cent) was administered. No premedication had been given. The patient was swallowing and was reacting to stimuli (mandibular extension) within one minute after the termination of surgery. She was transported to a recovery bed and left under the supervision of a nurse.

EMERGENCE—The recovery nurse reported that the patient slept quietly for ten minutes after the operation. When she opened her eyes, the nurse asked her how she was feeling. The patient answered, "Where am I? What am I doing here?" She did not respond to answers and reassurance, and one of us was called. Examination revealed total loss of memory for all the events of that day, nor did the patient have any recollection of having developed a toothache the preceding day. She was otherwise well oriented. Physical examination revealed no other abnormality.

The patient was understandably frightened and every effort was made to reassure her and to help her regain memory of the day's events. In spite of our efforts, her continued postanesthetic recovery was punctuated by uncontrollable sobbing and by cries of, "What has happened to me? What am I doing here?" After one hour, during which no progress was made, her companion was brought to the recovery room in the hope that a familiar face might affect recollection, or at least relieve the acute anxiety. The patient recognized the companion, an old friend, and an emotional outburst similar to the first ensued.

After another hour the patient regained partial control of her emotions, but the memory loss persisted as before. She was then taken to her own home in the care of the companion who remained in contact with us. The familiar environment of her home made no impression on the amnesia, so her sister was called to spend the night with her. At the same time her brother, a physician, was notified. He was most cooperative and agreed with our provisional diagnosis of hysteric amnesia and with our recommendation of observation and nursing care. He stated she was an "hysterical type."

FIRST POSTOPERATIVE DAY—On awakening on the first postoperative day, the patient was able to recall going to the office for an extraction. She remembered everything in detail, including the examination, up to the time shortly before the venipuncture, but she remembered nothing thereafter until she awakened the next morning.

FOURTH POSTOPERATIVE DAY—The patient appeared for her routine roentgenographic check on the fourth postoperative day. No change had occurred in her amnesia. She was most antagonistic during the examination and kept up a constant stream of complaints about how she had been treated. Every effort

was made to explain the probable mechanism of the amnesia, but this infuriated her even more. She refused to consider any possible cause other than the anesthetic agent. She was dismissed with all possible reassurances.

EIGHTH POSTOPERATIVE DAY—The patient was contacted on the eighth postoperative day in an attempt to complete our history of the case. Although the usual vituperation and complaints were forthcoming, she agreed to supply any desired information.

At that time her amnesia had narrowed to a period extending from shortly before the venipuncture to the time when her sister arrived at her home, a period of four hours. She had total recall for all events before and after that period. There were no other ill effects.

The continuation of her history was negative with respect to systemic review.

Past history revealed that a unilateral ovarian cystectomy and appendectomy had been performed in 1926. There was a history of severe, frequent migraine headaches starting in puberty and continuing up to two years ago. Since then the attacks have decreased in frequency and severity. They had necessitated 11 hospitalizations for observation and treatment. The patient claimed that usual methods had given little relief, but that chiropractic manipulation gave definite relief. In addition, she stated that she had suffered an "emotional disturbance" after her husband's death from coronary occlusion one and a half years earlier. She stated that she had suffered from "psychic" chest pains for one year after his death, but that she is "normal in every way" now.

Family history was essentially negative except for the fact that three of eight siblings suffer from migraine headache.

It was impossible to dwell more thoroughly on certain of the pertinent facts. The history was volunteered without questioning for the most part, and the patient avoided elaborating when further questions were asked.

COMMENT—The correlation between the disease entities discussed and this patient's history and experience is evident. It is felt that she has suffered for years from moderately severe anxiety hysteria, with evidence of previous somatic and anxiety symptoms. Apparently the emotional demands attendant on the oral surgery and general anesthesia were too much for her to tolerate, and she developed amnesia as a result. As stated by Sadler,[1] "Many neurotic and hysteric individuals do well if the environmental stress does not become too strenuous."

SUMMARY—An instance of circumscribed hysteric amnesia associated with oral surgery and general anesthesia was encountered. To the best of the authors' knowledge, no similar case has been reported. There are certain general psychoneurotic patterns that are applicable to the present case.—*123 Atlantic Avenue.*

■ Diagnosis

Diagnosis holds the first rank in all sciences and it is the most difficult part; without an exact and precise diagnosis, theory is always faulty and practice often incorrect.—*Guillaume Dupuytren (1777-1835).*

Unilateral benign osteogenic enlargement of the mandibular condyloid process: *report of cases*

■ *Raymond F. Huebsch,* D.D.S., and Thomas D. Stephenson,† D.D.S., Philadelphia*

Unilateral enlargement of the mandibular condyloid process as the result of benign osteogenic growth appears as a comparatively rare entity in the literature to date. Less than 50 cases were noted in a review of the literature. Unilateral condylar enlargements have been reported by different authors as hypertrophies, hyperplasias, osteomas, exostoses, hyperostoses and osteochondromas. In many instances several of these terms are employed synonymously, according to the classification of benign skeletal tumors consulted.

The etiology of these benign overgrowths is obscure and somewhat controversial. The unilateral configuration in a single bone would appear to rule out systemic etiologic factors such as hormonal imbalance and osteoarthritic disease. The initiating factors which have been considered by many authorities for bony and cartilaginous overgrowth at muscle and tendon attachments are the result of an excessive demand for function, trauma, heredity, inflammation, benign neoplasms such as giant cell tumor, infection and idiopathic cartilaginous hyperplasia followed by osteogenic replacement. The clinical course in the unilateral cases appears fairly constant, varying with the duration and size of the tumor. Progressive lateral deviation of the mandible with facial deformity, restriction of masticatory function, malocclusion, pain, and swelling over the affected joint are often noted.

CASE 1: UNILATERAL EXOSTOSIS OF MANDIBULAR CONDYLE—A well-developed, well-nourished 32 year old white man was referred to the U. S. Naval Hospital, Philadelphia, on November 30, 1954, with the complaints of an increasing deviation of the mandible to the left side, increasing facial asymmetry, masticatory pain in the region of the right temporomandibular joint, progressive loss of masticatory function and deafness in the right ear.

In July 1952, the patient had had an impacted right mandibular third molar removed. It had not been a traumatic procedure, and he had experienced no postoperative complications. Approximately two weeks after this extraction he noted a crepitation without pain in the right temporomandibular joint region. This crepitation had remained constant until October, when he first noted pain in the right joint region. In November, the crepitation ceased and the pain, noted especially when eating or when in a supine position, progressively increased in severity. In April 1953, the patient first noted a deviation of the mandible to the left side. Since that time, the pain and left mandibular deviation increased in magnitude, and he began experiencing increasing loss of auditory acuity in the right ear with recurrent earaches, also in the right ear.

Oral examination revealed the patient to have a noticeable prognathic mandibular deviation to the left side (Fig. 1). There was a cross-bite occlusal relationship on the left side. Lateral and protrusive mandibular excursions were restricted. Opening the mandible produced an increased deviation to the left. Palpation of the temporomandibular joints in func-

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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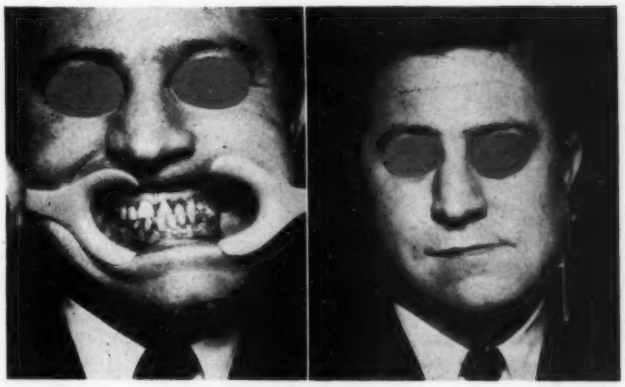

Fig. 1 (Case 1)—Preoperative views. Note malocclusion and deviation of mandible

tion revealed apparently normal movement of the left joint and almost complete immobility of the right joint with minimal crepitation. There appeared to be a fixed, bony mass over the region of the right joint.

Roentgenographic examination revealed a large bony mass, approximately 2.5 by 3 cm., in continuity with the superior and medial aspects of the right mandibular condyloid process (Fig. 2, left and center). This mass showed evidence of a slight coarsening of the trabecular pattern. Roentgenographic survey, including the pelvis, femurs, humeri, skull, and cervical, dorsal, and lumbar spine, failed to demonstrate any significant abnormality other than the asymmetry of the mandible and the bony mass of the right mandibular condyloid process.

Other than the oral findings, the only significant abnormalities noted were a considerable deviation of the nasal septum to the left as the result of an old nasal fracture, and recurrent right otitis media, evaluated by the otolaryngology service, as the result of eustachian tube obstruction occasioned by the mandibular asymmetry and the right condylar mass. A complete investigation by the medical service did not demonstrate any systemic disease; the bony tumor could not be accounted for on a systemic basis. Laboratory investigations, including a complete blood cell count, bleeding and coagulation time, Kahn test, erythrocyte sedimentation rate, urinalysis and blood chemistry determinations (calcium, inorganic phosphorus, acid phosphatase, alkaline phosphatase, blood urea nitrogen, uric acid and blood sugar), were all within the limits of normal.

Just prior to surgery, 24-gauge stainless steel eyelet loop wiring was attached to the teeth in all quadrants, under local anesthesia. A course of parenteral penicillin was initiated one day preoperatively and continued through the seventh postoperative day. On February 28, 1955, the patient was prepared for surgery under general anesthesia—intravenous thiopental sodium (Sodium Pentothal), intravenous decamethonium bromide (Syncurine) and oxygen-nitrous oxide inhalation anesthesia through an endotracheal oral intubation. Two per cent lidocaine with 1:50,000 epinephrine was injected in the region for hemostasis.

Through a submandibular Risdon-type incision, the angle of the mandible was exposed. The masseter muscle was detached subperiosteally at its insertion and reflected along with the parotid gland and branches of the facial nerve to expose the ramus of the mandible to the level of the surgical neck of the condyloid process. The soft tissues surrounding the enlarged condyloid process were dissected free with the use of blunt instruments. The condyloid process was sectioned at its base with bone burs, and the specimen was delivered intact (Fig. 2, above and below right). The sharp margins of the bone were removed with rongeur forceps and bone files. Diffuse venous

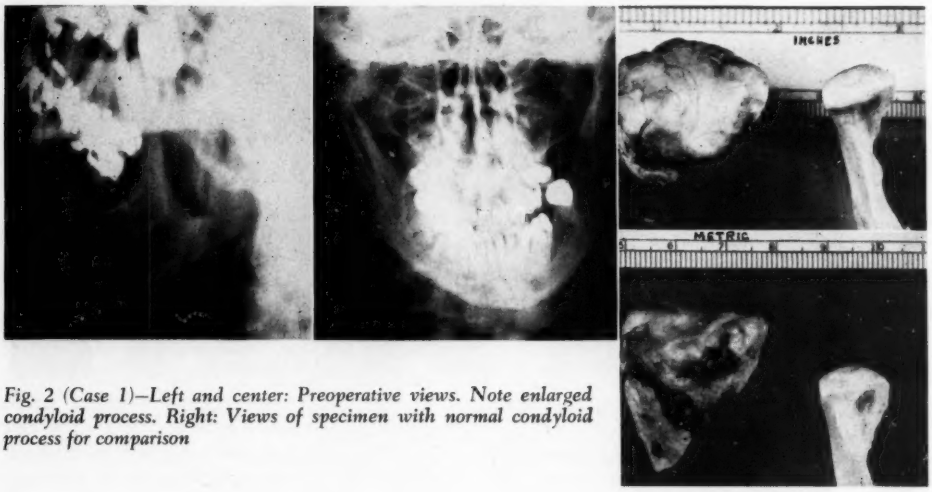

Fig. 2 (Case 1)—Left and center: Preoperative views. Note enlarged condyloid process. Right: Views of specimen with normal condyloid process for comparison

bleeding was controlled with Gelfoam saturated in a thrombin solution. The wound was closed in layers with catgut sutures, and the skin was closed with Dermalon blue monofilament nylon sutures. No drain was used, and a pressure dressing was applied to prevent hematoma formation. Intermaxillary elastic bands were attached to the previously applied loop wiring to bring the teeth into proper occlusal relationship.

The postoperative course was uneventful. The moderate swelling over the right aspect of the face subsided rapidly. The intermaxillary elastic bands were worn for three weeks except while eating. A regular diet was tolerated well, and the patient expressed satisfaction with the esthetic improvement, operative results and return of masticatory function (Fig. 3, left and center). Extensive equilibration of the teeth achieved optimum occlusion.

Postoperative roentgenograms revealed a smooth operative site (Fig. 3, right). The patient experienced relief from his earaches in the right ear, and there was progressive improvement to normal in the right ear auditory acuity.

The pathology report follows:

"*Gross:* Specimen consists of a condylar head which is cut off at the neck. Arising from the head of the condyle is a massive bony overgrowth which measures 3 by 2.5 by 1.5 cm.

"*Microscopic:* Histologic examination of the specimen submitted reveals that this bony overgrowth is covered by dense connective tissue in which there are few cells. From without inward, there is next a layer of small cartilage cells, then a stratum of large cartilage cells. Deeper, the cartilage cells are markedly enlarged and some are calcified. Next is an area where bone has formed around these cartilage cells, and finally, the innermost portion of the specimen consists of a trabecular bone with fatty marrow. Along the posterior border of the condyle there is a small space separating the overgrowth from the previous condyle head. There is no evidence of malignancy.

"*Diagnosis:* Exostosis, condyle of mandible."

CASE 2: EXOSTOSIS OF CONDYLOID PROCESS STUMP, SUBSEQUENT TO CONDYLECTOMY—A well-developed, well-nourished, nervous, 37 year old white man came to the U. S. Naval Hospital, Philadelphia, in November 1954, complaining of an increasingly severe pain in the region of the left temporomandibular joint. He had first noticed the pain in July. It was accentuated on mastication and talking, and had

become so severe that his diet was restricted to soft foods.

Review of his past history and old roentgenograms revealed that in January 1946, while overseas, he had sustained fractures of the mandible through the right body and left condyloid process. The head of the left condyloid process had been completely avulsed from the glenoid fossa and was lying medial to its normal position in a horizontal plane (Fig. 4, left). Reduction of the fracture of the anterior right body of the mandible had been accomplished at that time, resulting in complete union. The displaced left condyle had been left *in situ*. The patient had been comfortable and had remained asymptomatic until late 1951, when he began to experience frequent headaches in the left temporal, parietal and frontal regions. In early 1952, the headaches increased in severity, and he began noting restriction of his mandibular excursions with increasing masticatory pain in the left temporomandibular joint region. He had sought treatment in July 1952. At that time roentgenograms revealed that there was extensive fibrosis in association with the displaced left mandibular condyle, the glenoid fossa and the condyloid process stump. The displaced condyle was removed in October 1952, employing a preauricular, extraoral approach. The postoperative recovery had been uneventful, and the patient's headaches had subsided (Fig. 4, right). He had experienced moderate masticatory difficulty, and extensive equilibration, together with construction of an inclined plane mandibular splint, was achieved for occlusal guidance. Again, the patient was comfortable and possessed adequate masticatory function until July 1954, when he experienced a recurrence of his headaches and pain in the left temporomandibular joint during mastication. These complaints had increased in severity until his arrival at the hospital for examination in November 1954.

Oral examination revealed the following: (1) the patient was unable to open his mouth wide without severe pain in the region of the left temporomandibular joint; (2) lateral and protrusive mandibular excursions were noticeably reduced and were accompanied by severe pain; (3) the mandible deviated to the left on opening; (4) the left mandibular condyloid process was not palpable; (5) occlusion was satisfactory except for extrusion of the left mandibular second molar which was impinging

Fig. 3 (Case 1)—Left and center: Postoperative view. Note normal occlusion and esthetic improvement. Right: Postoperative view

Fig. 4 (Case 2)—Left: Preoperative view, February 1948. Note displaced condyloid process. Right: Roentgenogram subsequent to condylectomy performed in November 1952. Note exostosis forming on medial aspect of untouched condyloid process stump

on the maxillary alveolar crest tissues; (6) there was an old preauricular scar on the left side, evidently from his previous condylectomy and (7) the teeth showed evidence of extensive equilibration procedures.

Roentgenographic examination was within the limits of normal except for the absence of the head of the mandibular left condyloid process. An anteroposterior projection showed a triangular spur, or exostosis, approximately 1.5 cm. in length and 1.0 cm. at the base, at the superior medial aspect of the amputation stump of the mandibular left condyloid process (Fig. 5, left).

It was thought that this sharp spur, moving with the mandible, was responsible for his facial pain.

Other than the oral findings, the only significant abnormality noted was an incipient left inguinal hernia. Laboratory investigations, including a complete blood cell count, urinalysis, Kahn test and bleeding and coagulation time, were within normal limits.

The patient gave a history of a previous allergic reaction to parenteral penicillin. A course of oral oxytetracycline (Terramycin) was initiated one day preoperatively and continued through the ninth postoperative day.

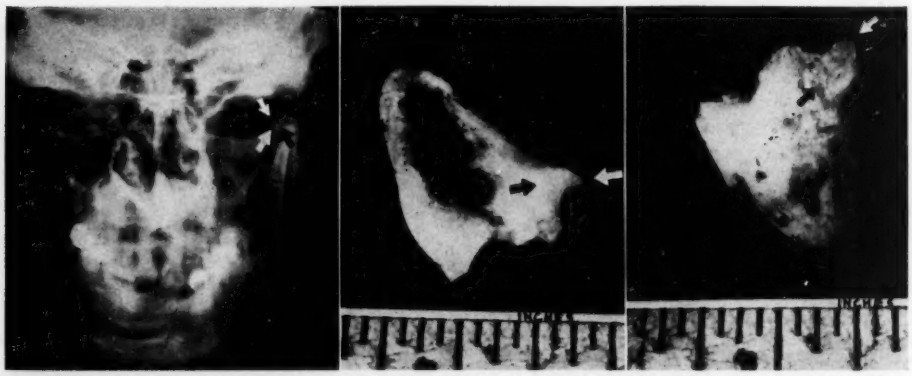

Fig. 5 (Case 2)—Left: Preoperative view showing exostosis just prior to surgery in November 1954. Note increase in size of spur over the two year period. Center and right: Medial and lateral aspects of specimen. Note spur

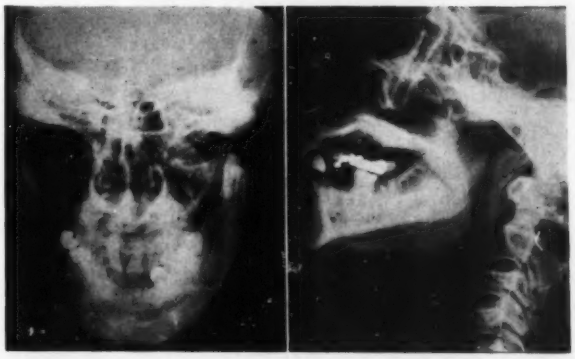

Fig. 6 (Case 2)—Postoperative views

On January 28, 1955, the patient was prepared for surgery under general anesthesia (intravenous thiopental sodium, intravenous d-tubocurarine, and oxygen-nitrous oxide inhalation anesthesia through an endotracheal nasal intubation). An extraoral, Risdon-type approach to the left ramus, identical to that described in Case 1, was employed. The masseter muscle was detached and reflected subperiosteally to expose the ramus of the mandible to the level of the sigmoid notch anteriorly and the amputation stump of the condyloid process posteriorly. The fibrotic adhesions in the region of the condylar process were removed. The soft tissues medial to the process were dissected free with blunt instruments. A broad-bladed periosteal elevator was passed medial to the process. Bone burs were employed to section the ramus inferior to the medial exostosis, and the specimen was removed intact (Fig. 5, center and right). The remaining sharp bony margins were smoothed with a bone rasp. Deep bleeding was controlled with Gelfoam saturated with a thrombin solution. Closure of the wound was accomplished in the usual manner.

The postoperative course was uneventful. A liquid diet was prescribed through the third postoperative day, at which time the patient tolerated a soft diet. There was considerable swelling in the operative region, but it gradually subsided. After that time, the patient had no complaints other than tenderness at the incision site, and he tolerated a regular diet. It was noted that the mandibular left second molar was causing discomfort due to impingement, and it was removed under local anesthesia.

Postoperative roentgenograms revealed a smooth bony outline at the operative site (Fig. 6). The patient noted a remission of his headaches, and his masticatory function was painless and satisfactory.

The pathology report was as follows:

"*Gross:* Specimen consists of a condylar process of left mandible. There is a large bony spur which extends in an anterior medial direction.

"*Microscopic:* Histologic examination of the condylar neck, which was sectioned in its narrowest dimension, reveals on one aspect a dense spur of compact bone. Sections through more normal areas reveal a heavy cortical plate and some evidence of hemopoiesis.

"*Diagnosis:* Exostosis, condyle of mandible."

DISCUSSION—In Case 1 are reported the almost typical history, clinical signs and symptoms, and microscopic picture of a benign unilateral osteogenic enlargement of the mandibular condyloid process occurring after general skeletal growth has ceased. History, clinical examination and laboratory investigations do not contribute to the obscure etiology of the enlargement. Treatment, as advocated by numerous authors, consists of complete removal of the bony overgrowth with the condyle.

Reported results of this treatment are uniformly satisfactory with regard to function, appearance and cure in instances of nonmalignant osteogenic enlargement.

In Case 2 are reported several of the complications inherent in nonreduction of condylar fractures and condylectomy procedures. Nonreduction of asymptomatic displaced mandibular condylar fractures, until the patient has complaints referable to the region, is the treatment of choice according to one school of thought. In reviewing the history of this patient, it will be noted that he was comfortable and possessed satisfactory function for approximately three years after his initial injury. When complaints traceable to this displaced condyle became acute, a removal of the fragment was accomplished. Close examination of the postoperative roentgenograms taken at that time revealed a small projection on the medial aspect of the untouched condyloid process stump (Fig. 4, right). This small projection probably represented either a small bone fragment or an unsmoothed bony margin. Evidently, the periosteum covering this projection initiated and produced gradual osteogenesis at the site. This exostosis gradually increased in size for two and a half years until it presented a traumatic obstruction to mandibular movement.

SUMMARY—Two instances of benign osteogenic enlargement or overgrowth of the condyloid process, occurring after puberty, are reported.

In instances of progressive mandibular asymmetry, disturbances in the temporomandibular region resulting in masticatory dysfunction, pain, or roentgenographic evidence of bony joint abnormality, a review of the patient's history, physical examination, roentgenographic evaluation, laboratory investigations and microscopic examination of tissue must all be considered in arriving at a diagnosis and in treatment planning.

The treatment of choice in benign unilateral local osteogenic tumors of the mandibular condyloid process appears to be surgical removal.

■ GROWTH OF UNDERSTANDING

The deeper insight man has into the affairs of nature, the more he discovers the accurateness and art of the creation, the more he will understand the contexture of all things.—*Sir Thomas Pope Blount (1693).*

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The role of nervous tension in the painful temporomandibular joint

THE ROLE OF NERVOUS TENSION in the production of temporomandibular joint pain cannot be overemphasized. Although many other factors may enter into the problem, nervous tension with its accompanying muscle tension, bruxism and chin thrusting, is almost always present. This, coupled with the observation that the majority of patients with painful temporomandibular joints are middle-aged women who are prone to develop nervous tension syndromes, should increase insight into this interesting problem.

Malocclusion is generally recognized as the chief etiologic agent in the production of temporomandibular joint pain; however, the lack of joint involvement in the countless millions of people that have had dental malocclusion, cusp interference and even complete lack of occlusion for many years is difficult to explain. Also, patients that have temporomandibular joint pain may have only relatively minor occlusal abnormalities.

In any event, the factor of tension habits should be considered carefully, for some degree of malocclusion coupled with nervous tension, bruxism or other abnormal occlusal or jaw habits almost invariably produces joint symptoms eventually. A frank discussion with the patient regarding tension factors is therefore in order. The knowledge that they may play an important part in the production of symptoms will do much to increase the patient's insight into his problem and will aid him in comprehending future treatment. Frequently, the patient is able voluntarily to eliminate some of the abnormal jaw habits he has acquired.

Occasionally, he may require added professional assistance. The use of mild sedation, light daily exercise in the form of walking or outside recreation are all conducive to relaxation and subsequent release of muscle tension. This, accompanied by correction of occlusal discrepancies and the use of a bite plane at night to eliminate the harmful effects of bruxism, may contribute greatly to the spontaneous recovery of an otherwise intractable condition.—*Fred A. Henny.*

James R. Cameron honored by American Board of Oral Surgery

JAMES R. CAMERON, retiring president of the American Board of Oral Surgery, was the honored guest at a testimonial dinner given by the Board, its Advisory Committee and wives at the Ambassador Hotel in Los Angeles, October 12, 1955. Dr. Cameron (above right) was lauded for his outstanding contributions to oral surgery, to the American Society of Oral Surgeons, and particularly to the American Board of Oral Surgery on which he served for a period of nine years. He was a founder member of that organization and climaxed his many contributions to that body by serving as its president from 1950 to 1955.

Leslie M. FitzGerald, representing the Board, presented Dr. Cameron with a sterling silver tray engraved with the names of the Board members and the Advisory Committee who served during his administration. The names engraved on the tray are as follows: Don H. Bellinger, Thomas Conner, Daniel J. Holland, G. Victor Boyko, Jack B. Caldwell, Athol L. Frew, Jr., G. Thaddeus Gregory, James R. Hayward, Fred A. Henny, Frank B. Hower, Leslie M. FitzGerald, J. Orton Goodsell, Phillip E. Williams, Gustav O. Kruger, Jr., Aubrey L. Martin, Sanford M. Moose, Louis W. Schultz, Edward L. Sleeper, J. J. Stetzer, Jr., and Ralph W. Taylor.

■ Local anesthesia often can be used to advantage in conjunction with general anesthesia to provide hemostasis and therefore improved visibility in the operative field; to allow a more superficial plane of general anesthesia even during a relatively prolonged operative procedure, thereby reducing the postanesthetic recovery period in ambulatory patients, and to reduce anesthetic risk in relatively debilitated patients.

■ Acute pericoronal infections of the mandibular third molar often are complicated by impingement of the opposing maxillary third molar on the edematous tissue. Treatment of such infections frequently can be simplified by extraction of the maxillary third molar. Such extraction usually is followed by sufficient reduction in symptoms to allow a delay in removal of the lower molar if a delay is desired.

■ The occurrence of postextraction hemorrhage can be reduced to a minimum by the application of sound surgical principles. These include careful surgery with adequate suturing of the wound; routine use of a postextraction gauze pressure pack over the surgical site with maintenance of the pressure for 20 to 30 minutes postoperatively, and adequate sedation when indicated, since pain and apprehension contribute greatly to the continuation of postoperative bleeding.

■ When postextraction hemorrhage occurs it is wise to follow a definite treatment plan including: (1) immediate use of a sedative to reduce apprehension, (2) local anesthesia to relieve pain and provide hemostasis, (3) removal of any excess blood clot protruding into the mouth, (4) inspection of the surgical wound to determine the bleeding points, (5) suturing of the wound to provide good approximation of the wound edges, (6) application of pressure with a gauze pack overlying the operative site, and (7) postoperative antibiotic coverage to promote wound healing. Actual packing of the extraction defect is contraindicated unless bleeding is uncontrollable with other measures, since it produces a more complicated, slowly healing wound.

Readers are invited to send their clinical observations to the editor, Fred A. Henny, Henry Ford Hospital, Detroit.

■ Roentgenographic Interpretation in Fractures

Q.—Frequently a roentgenological report of a broken jaw will describe two fractures of the mandible although only one can be demonstrated clinically. How can this be explained?

A.—A great majority of fractures of the body of the mandible or near the angle are oblique fractures. The fracture lines visible on the roentgenogram are shadows of the break through both buccal or labial and the lingual cortical plates. These lines are on a different plane because the break is not directly transverse but runs on an angle through the mandible, thereby casting two separate shadows. This roentgenographic appearance is well described in most oral surgery texts.

■ Local Treatment of Painful Extraction Sites

Q.—What medications may be used on dressings for painful tooth sockets in which there is a partial or complete loss of the blood clot?

A.—Hundreds of preparations have been advocated for treatment of painful tooth sockets. One which has given excellent results for 20 years is a thin paste made of chlorobutanol (Dentalone) and equal parts of thymol iodide and benzocaine powders. A satisfactory technic for the treatment of a painful socket which is partially or totally devoid of a blood clot is as follows: (1) The socket is irrigated gently with a warm saline or antiseptic solution. (2) A piece of one-fourth inch gauze is cut long enough to fill the socket without pressure. This gauze is saturated with the anodyne mixture; the excess is removed on a sterile gauze sponge. (3) The socket is dried carefully without allowing saliva to enter the socket; the impregnated one-fourth inch gauze is placed into the socket. This treatment will be effective for from 24 to 72 hours depending on the degree of osteitis and the threshold of pain of the patient. It may be repeated as necessary.

■ Painful Extraction Sites

Q.—How long should it be necessary to place dressings in sites of postextraction pain (alveolar osteitis)?

A.—Local dressings carry obtundent drugs to the sites of alveolar osteitis to relieve pain in the acute phase and thus reduce the requirements of systemic analgesic drugs. Dressings also promote drainage, obliterate dead space and protect the area from trauma and debris accumulation. Although beneficial for early phases of treatment, prolonged use of dressings after their need for pain control ends actually may interfere with repair processes. Symptoms of alveolar osteitis rarely last longer than a week to ten days. If pain persists one should be alert for local, systemic and roentgenographic evidence of osteomyelitis complications.

■ Office Use of Meperidine

Q.—Is the intravenous use of meperidine ever indicated for office use in oral surgery?

A.—When general anesthesia is used for the resistant patient, such as an alcoholic or for the patient who has an unusually high anesthetic

This section devoted to queries and comments from readers on topics of current interest to oral surgeons and general dental practitioners is edited by James R. Hayward, University Hospital, Ann Arbor, to whom readers are invited to send their communications. The answers, prepared by competent consultants, do not necessarily represent the opinions of any official scientific organization. Your participation in this section is invited.

The Editor

tolerance for the barbiturates, the intravenous use of meperidine (Demerol) will materially decrease the amount of general anesthetic agent required for adequate anesthesia. Given intravenously meperidine also may be helpful in patients who require special premedication. The amount administered intravenously will depend on the length of the surgical procedure, the tolerance of the patient and the physical condition of the patient. The average amount administered in office practice will vary between 50 mg. and 100 mg.

■ Submental Swelling

Q.—A patient has developed a painless small firm mass in the submental soft tissues during the past two months. There are no signs of inflammatory process in the mouth or jaws. What may be the cause?

A.—The swelling described may be a lymph node enlargement, cyst or neoplasm. The significance of immediate thorough investigation including aspiration or incisional biopsy should be apparent in view of the possible diagnoses.

■ Paralysis From Chemical Nerve Blocks

Q.—What are the potential dangers of motor paralysis from alcohol blocks for third division trigeminal neuralgia?

A.—The site of injection will, of course, determine the degree of involvement. Injection at the foramen ovale or into the ganglion are the only regions of significance. Since the effect is unilateral, no major dysfunction results.

■ Use of Contrast Material to Demonstrate Cysts

Q.—Are there any precautions to be followed in the use of radiopaque materials injected to demonstrate cysts of the jaws?

A.—Aspiration of cystic fluid and identification of a definite cyst wall are important preliminary procedures. If these characteristics cannot be demonstrated, a definite pathologic diagnosis should be established before the injection of any contrast medium.

■ Complications of Regional Anesthesia. By Daniel C. Moore, M.D. 291 pages with 51 illustrations and 25 tables. Index. $10.50. Springfield, Ill. Charles C Thomas, 1955.

This book is an expansion of a theme which the author discussed as part of a continuation course in anesthesiology. A medical anesthesiologist who has reviewed the literature in the field, Dr. Moore has added the observations of his experience in dealing with the various complications of regional anesthesia. These complications may be instantaneous or delayed by a considerable length of time, Dr. Moore states, and adds, "Every physician or dentist using a regional block technique is obligated to be fully aware of the inherent dangers of either type of complication. If he does not have the knowledge and facilities to institute effective treatment of these complications he should not employ the technique."

The book is divided into three major parts. The first part is devoted to complications of local infiltration and peripheral nerve block. In this section the major types of complications which the dental and medical profession may encounter are not only described, but the causes for the particular difficulties are clearly set forth. The signs, symptoms and treatment are well explained.

Such topics as the systemic reaction to high blood levels of a local anesthetic drug, allergic reactions, systemic reactions to the vasoconstrictor drugs used in certain local anesthetics, oxygen want, death and cardiac arrest, pain, and dermatitis are excellently presented in this part of the book. The emphasis is always on the correct diagnosis of the reaction to be followed by correct and vigorous therapy.

The second major division of this book is "Complications of Spinal and Epidural Blocks," a subject which is thoroughly covered. The third section deals with what the author chooses to call "Incidental Complications." Here the problems of broken needles, unsatisfactory anesthesia, amnesia following local anesthesia and complications of specific regional nerve blocks are discussed in an illuminating manner.

This reviewer found the book extremely well illustrated and well indexed. The subject bibliography is of recent material and is quite complete. It is a book which can easily receive an enthusiastic recommendation.—*Marvin Revzin.*

■ Root Canal Therapy. By Louis I. Grossman. Fourth edition. 399 pages with 140 illustrations. Index. Philadelphia, Lea and Febiger, 1955.

The fourth edition of *Root Canal Therapy* has been revised extensively. The addition of many references to the current literature has brought the book up to date. The chapters have been rearranged, and the chapters on treatment of deciduous teeth and history of endodontics that appeared in the third edition have been omitted. A chapter dealing with the rationale of root canal treatment has been added to the text.

The book can be divided roughly into four sections. The first section deals with the basic problems of pulpless teeth, pathologic conditions of the pulp and periapical tissues and clinical diagnostic methods. This section is followed by three chapters concerned with vital pulp therapy, including pulp capping and pulpotomy. Pulp mummification is included in this section also; however, the author, does not recommend the technic but includes it in the text for completeness.

The third part of the book includes ten chapters describing the technic of root canal therapy. A description of pulpectomy procedures, selection of cases, principles of therapy, anatomy of the pulp cavity serve as an introduction to the next five chapters which deal with preparation, irrigation, sterilization, culturing and filling the root canal. The last part of the text is concerned with root resection,

treatment of traumatized teeth and bleaching discolored pulpless teeth.

The book will be most useful as a text for undergraduate and postgraduate students and would make an excellent reference work for the practitioner who is interested in endodontics.—*William F. Via, Jr.*

■ HUMAN PHYSIOLOGY. By F. R. Winton, M.D., D.Sc., and L. E. Bayliss, Ph.D. Fourth edition. 616 pages with 236 illustrations. Index. $8. Boston, Little, Brown & Co., 1955.

Winton and Bayliss have done a laudable piece of work in the organization of their book. The material is presented concisely and is unfettered by the useless detail so common in some of the larger present-day physiology texts. In this edition, the two authors have enlisted the aid of some of their contemporary colleagues by inviting them to contribute pertinent material from their special fields.

The greater part of nine chapters has been rewritten since the third edition. Two new chapters have been included; one concerns body fluids and the other, transmission at nerve endings. Many illustrations have been changed, and several new ones have been added.

The bibliography of this text does not adequately represent the scope of material presented. However, the authors do suggest several reliable alternative reference sources to those readers who desire a more detailed analysis of the various sections.

This book would be an excellent text for dental or medical students as it contains the information necessary for a sound understanding of human physiology. The dental practitioner with a desire to learn more of the "how" and "why" of body function would find this book a worthwhile addition to his library.—*H. T. Perry.*

■ AN ATLAS ON DENTAL HISTOLOGY. By E. B. Manley, E. B. Brain and E. A. Marsland. Second edition. 91 pages with illustrations. $4.50. Springfield, Ill., Charles C Thomas, 1955.

This publication, produced in England at the University of Birmingham, is an excellent pictorial description of the microscopic structure of teeth and the supporting structures. It provides an adequate visual aid to the student, teacher and practitioner.

The first 65 pages include 134 photomicrographs organized under the following topics: enamel, dentin and pulp; the tissues of tooth attachment; tooth development; amelogenesis; epithelial attachment; and resorption of deciduous teeth. Each topic is preceded by a short, concisely written treatise dealing with the material presented. The photomicrographs are excellent duplications. The magnification used in making the photomicrographs is adequate, and the quality of the paper on which they are reproduced is of a nature that the fine details stand out clearly. Each photomicrograph is adequately described and clearly labeled, which makes them easy for the reader to interpret. The plates present new material.

Plate number 11, which appears on page nine and is intended to represent the distribution of an enamel lamella in longitudinal plane from a ground section of an unerupted tooth, may be questioned. It appears unconvincing; one wonders if the structure defined as lamella could possibly be normal enamel matrix which has not yet completed calcification.

The remaining 26 pages of the atlas deal with a description of histological technics utilized in the preparation of dental tissues. It contains 23 figures and completes a knowledge so important to those interested in the microanatomy of the dental tissues.—*George W. Burke, Jr.*

■ Deformities After Cleft Lip and Palate Surgery. J. Psaume. Rev. de Stomatol. 56:256 April 1955.

A complete analysis of cleft lip deformities including a study of the consequences of surgical repair is presented, since it is believed that repair is often responsible for deformity of an opposite type unless proper orthopedic measures are taken.

The natural forces of muscular action and growth may aggravate the deformity of an unrepaired cleft lip.

In the unilateral cleft of the lip and palate, the muscles which are inserted in the anterior nasal spine displace the extremity of the main fragment outward when the growth of the vomer bone pushes it forward. The small fragment on the side of the cleft is not submitted to such forces.

The tongue acts on both fragments but mostly on the main one. In bilateral cleft lip and palate, the muscles of the lip do not produce any action. The premaxilla is brought way forward by the growth of the vomer. The maxillary tuberosities always are displaced laterally by the force of the pterygoid muscles and the pressure of the tongue.

After repair of the cleft, the muscular balance that is established may be responsible for another type of disorder: in patients with unilateral cleft lip and palate, the main fragment is approximately in its normal position. However, if repair is done before five months of age, the development of that anterior part of the arch is disturbed with a resultant retrusion of the incisor region. The small fragment after repair is submitted to the forces of the orbicularis muscle and the anterior muscular sling. Its anterior extremity is displaced inward and comes behind the incisor region.

In the bilateral cleft lip and palate, an identical displacement of each small fragment behind the premaxilla has been observed after repair.

Among the deformities observed after repair are displacement of fragments; growth may be normal. In such instances, proper orthopedic measures can correct the disorder. An appliance for this is described.

Other deformities result from damage to the growing centers. Such atrophy is the consequence of too early or excessively traumatic repair. Treatment for this deformity is construction of a prosthesis to replace the missing bone and teeth.—*J. Levignac.*

■ Open Reductions of Mandibular Fractures. J. Levignac. Semaine d. Hôp. Paris. No. 8. Aug. 1955.

Among methods for open reductions of mandibular fractures, the general preference is for direct wiring of the bone fragments with stainless steel. However, in selected cases, a plate is of real value, and when indicated Smith's contoured type of splint is favored.

A patient with a bilateral fracture of the mandible was treated. There was a central edentulous fragment, associated with a unilateral fracture of the maxillary zygomatic arch. An open reduction of the mandibular fractures was performed utilizing a contoured adjustable Durallium splint. This splint, which is specially designed for use in the anterior portion of the mandible, has particularly attractive features. The main plate is on the lingual aspect of the mandible with rods engaging the lower border and coming around on to the anterior surface. The mandible was properly restored in this way, and by intermaxillary fixation the considerable displacement of the maxillary zygomatic arch was reduced.

Open reduction of condylar fractures has special advantages for bilateral fracture with dislocation and in fracture dislocation of the condyle in children.—*J. Levignac.*

■ Surgical Orthodontics: Technic and Case Reports. Edward L. Sleeper, D.D.S. The Alpha Omegan 49:110 Sept. 1955.

A technic first advocated by Holland is useful for the surgical implantation of unerupted or impacted teeth into their proper position. In rotating or moving the teeth into position through the creation of an osseous channel, the patient is spared the tedious procedure of having the exposed tooth banded and moved orthodontically.

This procedure is indicated only in carefully selected cases. In such instances, the technic can be performed with a reasonable degree of safety and assurance.

After surgical movement, sensory sensation will be lost, though there is re-establishment of blood supply. Success can be based on clinical and roentgenographic studies postoperatively.

In those instances where teeth are completely removed in order to facilitate repositioning, a splint should be utilized to maintain stability until replantation is effected. These teeth will tighten and become firmly fixed in the alveolar bone with formation of a lamina dura. This technic can be applied to any teeth which have been traumatically injured provided there is no periodontal disease.—*Bruce L. Douglas.*

■ The Treatment of Temporomandibular Joint Ankylosis. Cernea. Rev. de Stomatol. 56:292 April 1955.

A problem in the treatment of temporomandibular joint ankylosis is the problem of the age at which the operation should be done so as not to interfere with the remaining growth potential. It has been noted that in a few instances of bilateral ankylosis in adults, the ascending and horizontal rami were approximately of normal length, whereas severe deformities have been observed when arthroplasty was done on a young child. In addition, there is the risk of recurrence in children, with the possibility that the bony mass could invade the entire pterygomandibular fossa and thus become more and more difficult to remove.

From a prophylactic standpoint and so as to avoid ankylosis after condular fracture in a child, roentgenotherapy is advised at doses which may prevent the constriction and yet not damage the growth center of the condyle.—*M. Levignac.*

■ Treatment of Maxillofacial Injuries in Korea. Capt. Julius A. Howell. Plast. & Reconstruct. Surg. 15:37 Jan. 1955.

Since World War II, major advances have been made in military medicine. Probably the most important improvement has been the rapid evacuation of severely injured personnel by helicopter, an improvement which makes possible the early performance of definitive surgery. The type of facial injury most commonly seen in battle areas is the penetration of shell fragments into the soft tissues, eyes, and facial bones. The eye magnet provides a useful means of extracting metallic foreign bodies from the soft tissues of the face and from the accessory sinuses. The surgical repair of such maxillofacial wounds at an evacuation hospital in Korea is described.—*Irwin A. Small.*

■ The Development of Antibiotic-Resistant Organisms: Its Significance to the Dentist. Stanley J. Behrman, D.D.S. New York D. J. 21:297 Aug.-Sept. 1955.

A large percentage of the population can be considered carriers of resistant staphylococci strains. This percentage is steadily increasing. It is to be assumed, therefore, that dentists also frequently carry these organisms on their hands and that, in the absence of sterile technic, could introduce them into open surgical wounds.

The dangers of resistant strains are increasing, and the internist and general surgeon can expect more and more trouble in treating diseases of bacterial origin.

The dentist likewise will be confronted with the problem of increased difficulty in treat-

ing infections, increased danger of operating in the presence of acute infection and the possibilities of cross-infection of wounds. In addition, increased stubbornness of root canal infections can be anticipated.

Culture tests should be used when available, even if antibiotic therapy has already been started. Adequate surgical intervention and sterile technic are important. Frequently, the unavailability of laboratory facilities for performing culture tests in the dental office necessitates keen clinical judgment. The antibiotics which are selected to treat an infection must be chosen on the basis of a sound diagnosis, prescribed in sufficient quantities and used for an adequate period of time.

The dangers inherent in this developing phenomenon are obvious. The treatment of bacterial infection is overwhelmingly important to the practice of dentistry. Every dentist must be aware of these changing conditions in relation to the various ramifications of the infectious process.—*Bruce L. Douglas.*

■ **Cleft Lip and Cleft Palate—A Review of Embryology, Pathologic Anatomy, and Etiology.** M. Leon Canick, M.D. Plast. & Reconst. Surg. 14:30 July 1954.

The normal anatomy and normal embryology of the lip and palate are discussed. The pathologic anatomy of the cleft lip and palate are described also, and the embryology of these defects is discussed in detail. The classical hypothesis is that these anomalies are the result of failure of fusion, or incomplete fusion, of the face buds in the case of the cleft lip and of the palatine processes in the case of the cleft palate.

This theory, however, leaves unexplained the simple or partial clefts, the clefts where epithelial bridges have remained postpartum, and does not explain why much greater defects of nearby organs do not occur. The newer concepts of Veau appear to explain these anomalies more accurately. This modern hypothesis states that the fusion of the face buds, particularly in cleft lip, is not a complete process in itself. Actually the defect is due to failure of mesodermal tissue invasion into the epithelial wall either through the preventive action of the epithelium or the poor quality of the mesodermal tissue as it invaded—with subsequent atrophy and separation.

Complete cleft lip may originate also in cysts situated in the epithelial wall, which can break through secondarily to the nasal and oral cavities. When the cleft is not complete—that is, when it is simple or partial—or when there is an epithelial bridge either intact or with a remnant remaining, it is felt that an intrinsic necrotic tendency in the epithelial wall exists or that the mesenchyme fails to penetrate the epithelial wall. The further excess growth of the margins of the cleft are then due to the growth tendencies of the facial bones.

There are various theories concerning the genetic factors which can be implicated in the pathogenesis of cleft lip and palate. Various hereditary or environmental etiologic agents cause these anomalies. Greater attention should be paid to the culpability of hereditary factors and more careful histories and physical examinations of antecedents will uncover a greater incidence of familial disposition.—*Myron Kaufman.*

Announcements

■ Items From 22 Countries in Dental Abstracts' First Issue

The first issue of the Association's new magazine DENTAL ABSTRACTS, which appeared in mid-January, contained abstracts from articles published in 62 dental and allied periodicals from 22 countries. Of the 104 items, 75 appeared first in English language publications and 29 in other languages.

"It would be an impossible task for the average dentist to try to find these articles for himself," said Lon W. Morrey, editor, in commenting on the first edition. "DENTAL ABSTRACTS brings together in one place the important research from all over the world. The continuing education of the dentist is thus made easier."

Among the articles abstracted for the first issue were ones on a method of localization of a foreign body in the facial regions, transplantation of developing teeth, treatment of trigeminal neuralgia, an article originally in French on radical therapy in sinusitis and one from the German on new treatment methods for jaw fractures.

Each issue of the magazine contains articles in basic science, periodontics and endodontics, operative dentistry, orthodontics, oral surgery and professional activities.

■ Plastic Surgery Clinic Opens in New York

A new clinic for reconstructive plastic surgery of the face was opened recently in a new wing of the Manhattan Eye, Ear and Throat Hospital in New York. John Marquis Converse, M.D., is surgeon-director of the clinic. Funds for the clinic were raised by the Society for the Rehabilitation of the Facially Disfigured. Two well-known members of the dental profession were among the guests of honor at dedication ceremonies. They were Robert H. Ivy, professor emeritus of maxillofacial surgery at the University of Pennsylvania, and Varaztad H. Kazanjian, professor emeritus of plastic surgery, Harvard University.

Others participating in the clinic's opening were R. Townley Paton, M.D., chairman of the board of surgeon-directors of the hospital; Howard A. Rusk, M.D., chairman of the department of physical medicine and rehabilitation, New York University-Bellevue Medical Center, and Basil MacLean, M.D., commissioner of the Department of Hospitals, City of New York. The staff of the new clinic includes a coordinated team of specialists in fields associated with plastic surgery. A teaching clinic will be developed as part of the organization's program.

■ Roster of Officers Reported by Anesthesiology Society

Officers elected at the October 15 and 16 meeting of the American Dental Society of Anesthesiology held at the Sir Francis Drake Hotel in San Francisco were: William B. Kinney of Ogden, Utah, president; Cloyd Schultz of Lebanon, Pa., first vice-president; Harcourt M. Stebbins of Lake Charles, La., second vice-president, and Arthur J. Follenius of Staten Island, N. Y., secretary-treasurer.

Chairmen of the standing committees are: Leonard M. Monheim of Elizabeth, Pa., advisory board; Edward C. Thompson of Urbana, Ill., policy; C. William Vize, constitution, bylaws, rules and public policy; Ralph F. Tower of Denver, membership and credentials; Bruce L. Douglas of West Hempstead, N. Y., editorial; Richard Burch of Lackland Air Force Base, Texas, military affairs; Stanley Spiro of Hempstead, N. Y., program, and John S. Cotton of Long Beach, Miss., American Dental College of Anesthesiology.

■ Joseph Conlon Heads Middle Atlantic Society of Oral Surgeons

Elected president of the Middle Atlantic Society of Oral Surgeons at its recent meeting in Baltimore was Joseph F. Conlon of Washington, D. C. Frank N. Carroll of Wheeling, W. Va., was chosen president-elect. Also elected were Lloyd E. Church of Bethesda, Md., vice-president, and Edward C. Armbrecht of Wheeling, W. Va., secretary-treasurer. The next meeting of the society will be April 18 in Washington, D. C. States covered by the Middle Atlantic Society are Maryland, Pennsylvania, Virginia, West Virginia and the District of Columbia.

■ Somatoprosthesis Taught at Marquette

Training in somatoprosthesis, the construction of prostheses for various parts of the body, is offered by the department of oral rehabilitation at the School of Dentistry, Marquette University, Milwaukee, according to a recent announcement by Dean O. M. Dresen. The study of somatoprosthesis is offered so that dentists may provide adjunctive service to the plastic surgeon and other members of the medical team concerned with problems involving prostheses. The department offers courses also in maxillofacial prosthesis.

The school's department of oral rehabilitation is under the direction of Thomas J. Zwemer. Its primary concern is the care of the cleft palate-cleft lip patient and the patient with cerebral palsy. The program is carried out in cooperation with Milwaukee Children's Hospital and the Cerebral Palsy Clinic.

■ Symposium to Highlight Pathology Meeting

Tumors of the soft parts of the oral cavity is the subject of a symposium planned as a feature of the April 8 and 9 meeting of the American Academy of Oral Pathology. The Academy's annual session, which will be held the first day of the meeting, is scheduled for the Hotel Woodner in Washington, D. C. The April 9 symposium will be at the Armed Forces Institute of Pathology. Arthur Purdy Stout is moderator.

On April 7, the Academy will conduct its Fellowship examination at the Armed Forces Institute of Pathology. Information on the examination as well as on the meeting may be obtained from Col. Joseph L. Bernier, Armed Forces Institute of Pathology, Washington 25, D. C.

■ Maxillary and Mandibular Bone Chosen for Topic of May Conference

Maxillary and mandibular bone will be the topic of the fifth annual conference of the Second District Dental Society and the Brooklyn Veterans Administration Hospital. The conference is May 4 at the hospital. Nine essayists have been announced. They are: Alexander W. Kruger, M.D., manager of the hospital; Gerrit Bevelander, Ph.D., department of histology, College of Dentistry, New York University; Philip Person, chief of dental research at Brooklyn VA Hospital; Lester R. Cahn, associate professor of oral pathology, Columbia University; S. Sigmund Stahl, assistant professor of periodontology, New York University; Maurice J. Hickey, M.D., dean, School of Dental and Oral Surgery, Columbia University; William F. Harrigan, M.D., head of the department of oral surgery, New York University; Theodor Blum, consultant in oral surgery, the New York Institute of Clinical Oral Pathology and Brooklyn VA Hospital, and Saul Schluger, associate clinical professor, Columbia University.

■ Applications for Oral Pathology Examination Due July 1

Applications for the next American Board of Oral Pathology certification examination must be completed by July 1, according to a recent Board announcement. The examination is December 8 and 9 in Washington, D. C. Further information may be obtained from the secretary, Donald A. Kerr, University of Michigan School of Dentistry, Ann Arbor, Mich.

■ Institute of Dental Medicine Offers Case History Service

Case histories in dental medicine for the 1955-56 year are now being offered by the American Institute of Dental Medicine. The case histories include original 35 mm. Kodachrome slides of the oral condition, pertinent laboratory observations, medical background, roentgenograms, histologic slides, photomicrographs and diagnostic criteria. Case histories are sent out monthly to subscribers. Information on the case history service may be obtained from Mrs. C. Novembri, secretary, 2240 Channing Way, Berkeley 4, Calif.

■ November Dental Medicine Meeting to Feature Five Essayists

Francis L. Chamberlain, associate clinical professor of medicine at the University of California in San Francisco and Milton B. Engel, associate professor of orthodontics at the University of Illinois College of Dentistry, are two of five essayists who will appear on the program of the November 4-8 meeting of the American Institute of Dental Medicine. The meeting will be held in Palm Springs, Calif. Donald A. Kerr, professor of oral pathology and periodontics at the University of Michigan; Helmut A. Zander, professor of periodontology at the University of Minnesota, and S. I. Hayakawa, of the language arts department of San Francisco State College, also will speak.

■ Oral Manifestations of Systemic Disease Is Topic of Dental Medicine Meeting

Oral and physical manifestations of systemic disease will be the topic under discussion at the June 21-24 meeting of the American Academy of Dental Medicine to be held in Detroit. Participants will discuss endocrine and nutritional imbalance, circulatory disturbances, dermatologic and allergic disturbance, roentgenographic manifestations as well as laboratory tests which aid in oral diagnosis. Among the essayists are Robert L. Schaefer, M.D.; Donald A. Kerr; Raymond W. Monto, M.D.; Alice E. Palmer, M.D.; Jacques P. Gray, M.D., and William Umiker, M.D.

Two honorary memberships will be conferred during the June meeting. They will go to Donald A. Kerr of the University of Michigan School of Dentistry and Edward C. Stafne of Mayo Clinic.

■ Harry Sicher to Teach Two Courses at Alabama School

Harry Sicher will present two courses at the University of Alabama School of Dentistry in Birmingham during May. The first, entitled "Surgical Anatomy of the Head and Neck," is scheduled for May 7-9. The second, "Etiology and Diagnosis of Pain of Dental Origin," will be given May 10 and 11.

Editorial communications

■ ORIGINAL COMMUNICATIONS—This journal invites concise original contributions in the broad field of clinical and experimental surgery of the mouth and associated structures, including roentgenology, diagnosis, anesthesia and oral surgical pathology. Articles are accepted for publication with the understanding that they are contributed solely to the JOURNAL OF ORAL SURGERY. All manuscripts are subject to editorial modification. Neither the editors nor the publishers accept responsibility for the views and statements of authors expressed in their communications.

■ MANUSCRIPTS—Manuscripts submitted for publication should be sent to Fred A. Henny, Editor, Henry Ford Hospital, Detroit, Michigan.

Manuscripts should be typewritten on one side of the paper only with double spacing and liberal margins. The author's name and abbreviated title of the article should appear at the top of each manuscript page. The original should be sent to the editor and a carbon copy retained by the author. Manuscripts will not be returned if accepted for publication.

References should be placed at the end of the article and should conform to the style of the Quarterly Cumulative Index Medicus; viz., name of author, title of article and name of periodical with volume, pages, month and year. They should be numbered and should appear in the same order as that of the superior figures inserted in the appropriate positions in the text.

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